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Vol. XLV

1/-

FLIGHT

and
The AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

MARCH 16th, 1944

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FLIGHT and The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

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The Outlook

The Air and the Sea

THAT warships and aircraft now completely dovetail their respective capabilities, and produce as a result sea power, was the feature of Mr. Alexander's Naval Estimates speech last week which will most impress students of sea warfare.

The First Lord spent most time in dealing with the Battle of the Atlantic, which is no longer a struggle only against the U-boat, for the Germans are using an increasing number of aircraft, partly, no doubt, for reconnaissance so as to guide the submarine captains, but also as a striking force. They are obliged to use every device possible, for the U-boat alone has very nearly been beaten by the combined efforts of British escort vessels, the Fleet Air Arm, and Coastal Command. Some idea of the latter's method of working may be gained from an article in this issue.

It is useful to look back (though it arouses very painful thoughts) and recall, as Mr. Alexander did, that in 1941 one ship was lost out of every 181 which sailed. Next year the figure had fallen to one out of every 233 ships, and in the second half of 1943 less than one in every 1,000 was lost.

But the Germans have not admitted defeat. The First Lord said that they now probably have at least as many U-boats as they had at the beginning of 1943, and that more concrete shelters are now being built in the operational bases. Bombing has restricted the output to some extent, but it has never been claimed as one of the chief features in the growing British and American success. The Prime Minister has said that the best place to destroy U-boats is around the convoys; but the patrol carried out by Coastal Command over the Bay of Biscay is believed to have had not inconsiderable successes. At any rate, the Germans have vigorously opposed it.

Mr. Alexander wisely refrained from allotting the chief share of our success to one factor or the other. That success is one of the numerous instances in this war in which team work has proved the all-important thing. Of course, when there was a gap in the middle of the Atlantic where our aircraft could not work, the team was not complete. That gap has been bridged by the escort carriers of the Fleet Air Arm and by the V.L.R. aircraft of Coastal Command, and immediately the bridging had been accomplished the losses on that stretch began to diminish.

Mr. Alexander rightly looked ahead to the final blow, when we shall bear down upon Japan, and he prophesied, as *Flight* has repeatedly done, that it would be mainly a naval and air war. "Our maritime forces," said the First Lord, "will be more obviously than for generations past the corner-stone of our whole strategy." In those operations he foresaw that the Fleet Air Arm will be called upon to play "a peculiarly vital part." Admiral Nimitz has already set an example of how to use carriers with a fleet, and when the time comes British naval planning will obviously be in accord with that of the United States.

Another Point of View

ADMIRAL NIMITZ, the American Commander-in-Chief in the Pacific, has also made some remarks about the work of carriers in the war against Japan, and they seem at first sight not quite to tally with the views of Mr. Alexander. In all probability the quotations from his speech which have been reported do not give a full picture of the Pacific naval war as the American Admiral sees it; but none the less they should be noted.

He is reported to have said that Japan would be "pounded most effectively" from bases to be estab-

lished on the China coast. It was always possible, he said, to attack objectives from aircraft carriers, but "we have learned in Europe that a great weight of explosives is necessary to produce a considerable effect on land objectives, and carrier aircraft do not carry this weight of explosives."

Certainly no aircraft capable of carrying an 8,000 lb. bomb could be flown off any existing carrier; and there are not enough carriers, even in the American fleet, to compensate by numbers for the small load carried by the machines of each of the ships. Therefore, if Japan is to be pounded in the same way as the industrial centres of Germany are now being pounded, it follows that bases must be acquired on the mainland of China.

The point then arises, will it be possible to win those bases in China before Japan has been strategically defeated by an Allied naval victory? If the Japanese battle fleet is once defeated by the combined fleets of America and Britain, all the Japanese armies in occupied islands will be cut off from their base and supplies, and will be doomed to destruction.

On the mainland of Asia she is well established, and it will need a great effort to expel her from Burma, Siam, Indo-China and China proper. It seems unlikely that the Allies' land victory, which would make it possible to bomb Nippon from Chinese bases, can be won before the naval victory is accomplished

Achievement—and a Challenge

FOR the first time since the war started a Government spokesman has lifted the veil which has hitherto shrouded our production efforts. Mr. Lyttelton's statement is to be welcomed on several grounds, not the least being that he has told the world that Great Britain's contribution has been far greater than most people had imagined. Indeed, in proportion to our population it has been prodigious.

That we produced in these islands, from the outbreak of war to the end of 1943, no fewer than 90,000 aircraft is impressive, to say the least. But if it is remembered that at the beginning of the war our aircraft production rate was very low indeed, the achievement of an *average* of 1,875 aircraft per month (taking 1940-43 only and disregarding the last months of 1939) is one of which all concerned may well be proud.

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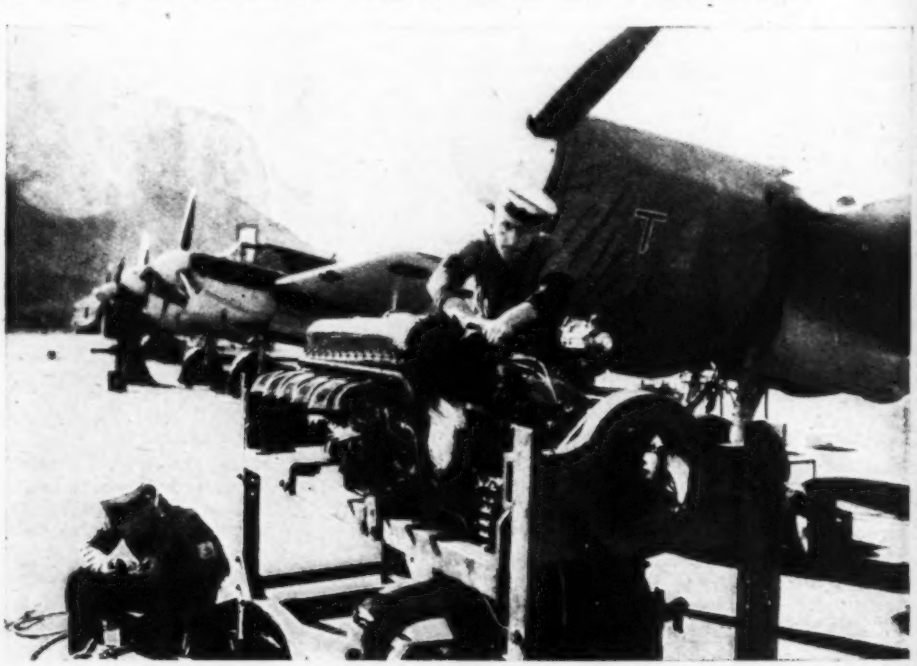
What makes the average figure all the more remarkable is the fact that a large proportion of our aircraft production has been heavy bombers. These, as Mr. Lyttelton pointed out, need four times as many man-hours as fighters and 40 times as many as trainers.

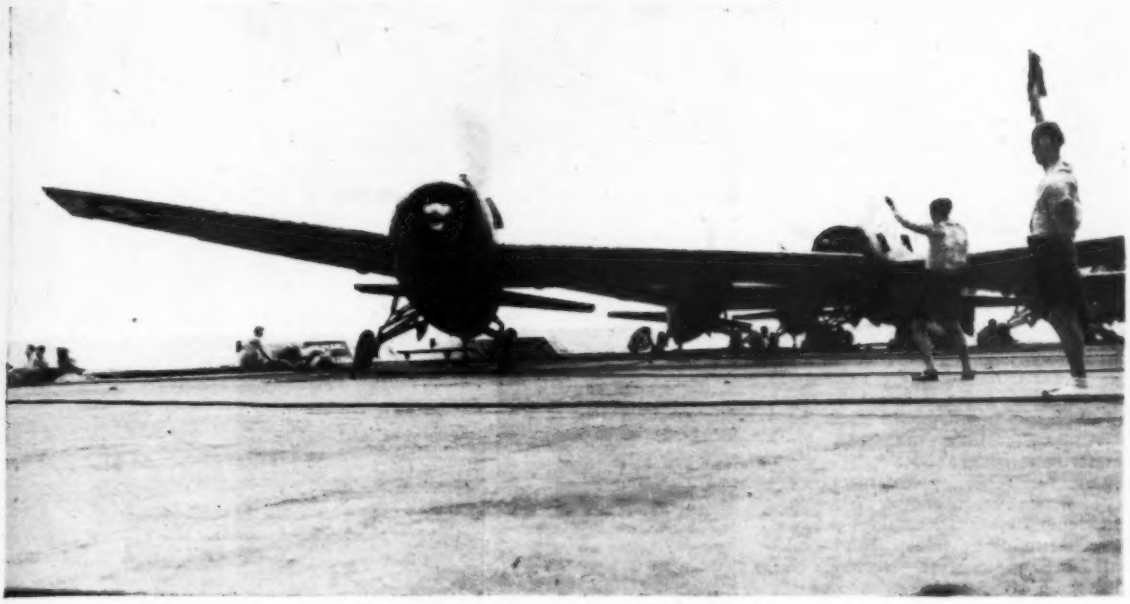
It will be welcome news to our own people, and may have a salutary effect on others who have been inclined to belittle our effort, to learn that as a result of our efforts three-quarters of the total aircraft structure weight for the R.A.F. and Fleet Air Arm during 1943 was produced in this country. Six per cent. came from the rest of the British Commonwealth, and 18 per cent. from America.

While taking justifiable pride in these achievements Mr. Lyttelton warned the country that in the aircraft programme there must be changes in the form of increased production of types of proved superiority and reduced production of others less excellent.

Mr. Lyttelton concluded his statement with a challenge to industry in 1944: In spite of reduced man-power we shall have to increase production in certain specialised directions. Although not directed especially to the aircraft industry, Mr. Lyttelton's concluding words might well be displayed prominently in every aircraft factory: "Our fighting men will face great battles this year. We must see that our work is worthy of them."



ABOARD H.M.S. *CORMORANT:* Mark II Beaufighters being serviced on the Gibraltar airfield. It is the Royal Navy's usual practice to give ships' names to shore stations. The airfield is on the site of the old racecourse between the Rock and the strip of neutral territory which separates Gibraltar from Spain. It is to this airfield that Coastal Command aircraft can be routed if the home base weather becomes bad while they are on patrol over the Bay of Biscay.



TALK ABOUT TORQUE : These Martlets look as if they are sitting back ready to spring off the flight deck of H.M.S. *Illustrious*.

WAR in the AIR

Repeated Raids on Berlin : Forcing the Germans to Fight : General Spaatz Leading Out Trumps

THE German fighter pilots must be getting desperately short of sleep. By day as well as by night now the R.A.F. and the Americans pound the great industrial centres of the Reich, and each mighty raid has to be opposed by all the fighter strength which the *Luftwaffe* can put into the air. The German pilots fight hard too, but it is reported that training machines have been noticed among the numbers which have attacked the Americans. If this is correct, it shows that despite the increase of first-line strength by 1,000 machines during the last year the fighters are being stretched beyond their limits. Their losses, too, have been heavy. Overtired men often fight bravely, but they seldom are in that fine fettle which gives the best result for each sacrifice. Moreover, heavy casualties without a corresponding result must have a depressing effect. It has recently been announced that the Richthofen Squadron has had its sixth commanding officer killed in action; that squadron can scarcely go into action now with an absolute assurance that it will sweep all before it.

One very obvious result of the strain now laid upon the fighter branch of the *Luftwaffe* is the slightness of the opposition encountered by the day sweeps carried out practically every day by the 2nd Tactical Air Force and the 9th Air Force of the American Army. Their Marauders and other medium and light bombers, fighter-bombers, and fighters range daily over occupied France and the Low Countries, and very rarely are they opposed. No rest is given to the "military objectives" in the Pas de Calais, and many of the airfields from which the German bombers used to start for their week

MADE U.S. BY U.S. : The remains of Japanese aircraft and buildings on Roi island airfield in the Marshalls, after the pre-invasion bombardment.

WAR IN THE AIR

of night raids over London have been heavily attacked. If Hitler's secret weapons lurk there, the crews in charge of them must be leading a sordid life. Some of them at least must have quitted this life altogether.

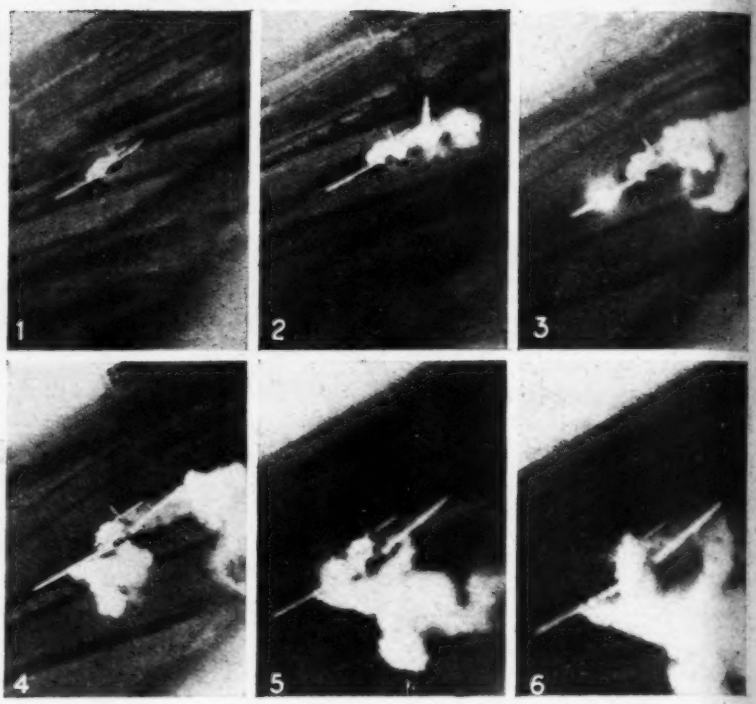
For a while one knew that the absence of German fighter opposition to the day offensive by the lighter classes of aircraft was deliberate policy, intended to conserve fighter machines for bigger occasions. Now we must doubt whether it would be physically possible for those fighters to do more than they are already doing, that is to say attacking the inroads of the heavy bombers.

And all the time the attacks on aircraft factories go on, reducing the chances of replacing lost machines.

It is really astounding to see how suddenly the American daylight raids over Germany have leapt from moderate, rather tentative, probings into full-scale attacks of terrific force and weight. A single Fortress or Liberator does not carry the same weight of bombs as a Lancaster or a Halifax, but the Americans claim that that is not necessary, because (so long as they can see their target) the greater accuracy with which the bombs are dropped on individual targets by day means that each bomb does more effective damage to the enemy's production than is done by area bombing at night.

One major contributing factor has been the development of satisfactory fighter escorts. Sometimes as many as 1,000 fighters take part in the escorting of a single raid. Of course they do not all fly all the way with the bombers. A series of reliefs is organised, whereby the new guard (as we might describe it in Army terms) flies ahead to a certain point at cruising speed and at the most economical fuel mixture, so that it has plenty of petrol in its tanks when the raid reaches the point of contact. The old guard of fighters may have been engaging in combat on the way, and combat uses up petrol at a great rate. The old guard then thankfully turns for home, usually (it is to be hoped) with enough fuel in its tanks to get there, while the new guard takes over. This process may be repeated several times on a raid.

This development of the long-range escort fighter has made possible the recent concentrated attacks on aircraft factories, especially fighter factories.



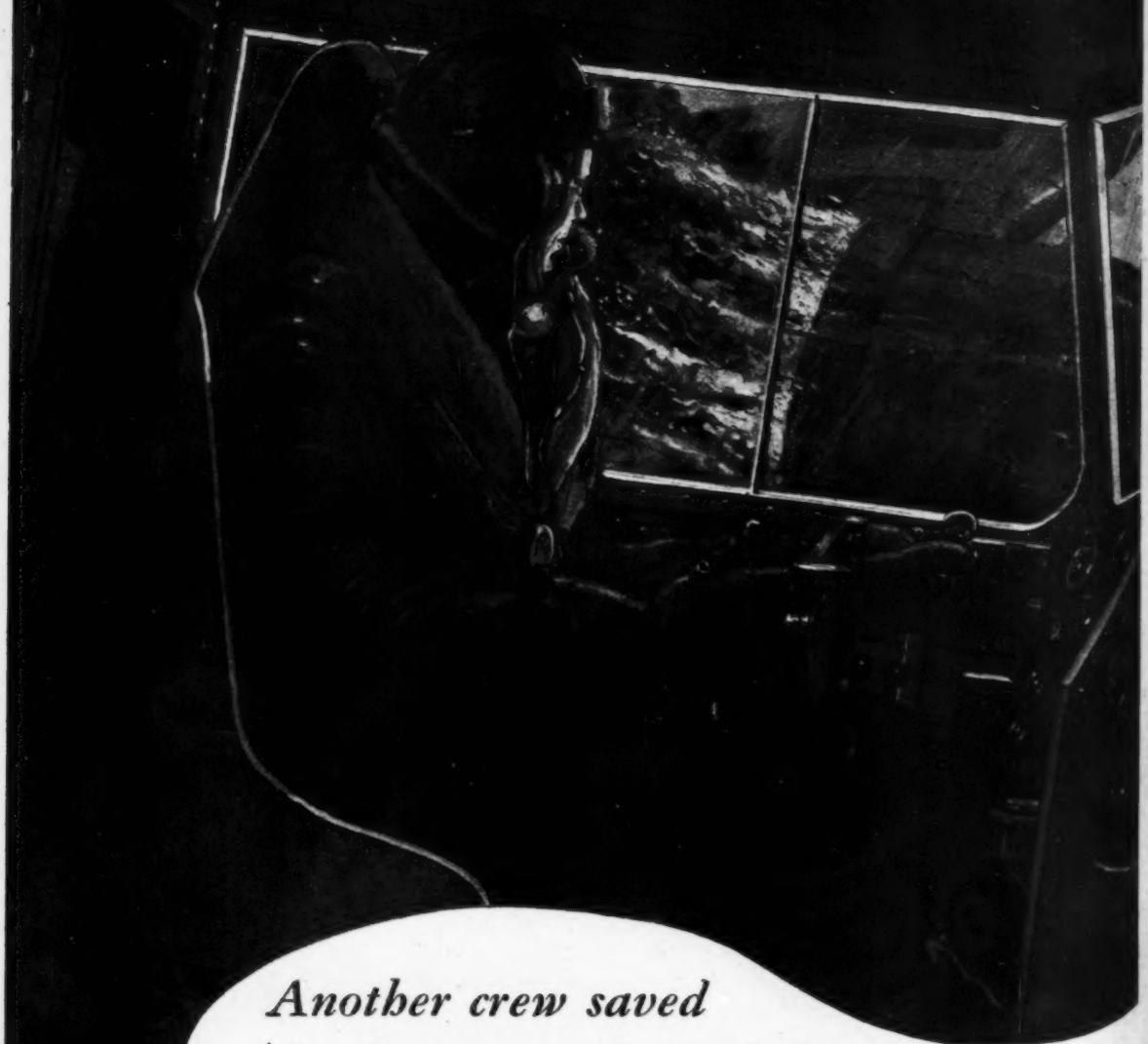
SUDDEN END : Six stages from a sequence of photographs taken by a Typhoon pilot as he shot down a Me 109G which had just taken off. He opened fire at 175 yards and closed to 75 yards for the kill.

NORTH AMERICAN ROLLS : The cannon-armed P.51 N.A. Mustang with Rolls-Royce Merlin LXVIII engine. With long-range tanks its fighting radius is said to exceed 450 miles. As a fighter-bomber it can carry up to 1,000lb. of bombs.

Advt.] A Hawker Hurricane "Tank-buster," with its two 40 mm. cannon, prepares to dive through the clouds in search of prey. *["Aeroplane" photograph.*

"The next thing I knew was that the engine was on fire. There are, as you know, lots of buttons, gauges and gadgets in the cockpit of an aeroplane, but I found my extinguisher button at hair-trigger speed. The fire was doused, leaving a trail of smoke behind it."

Extract from a broadcast given by a flying officer on May 16.



Another crew saved
for Britain with the help of . . .

GRAVINER

FIRE-FIGHTING EQUIPMENT

GRAVINER SERVES THE ROYAL AIR FORCE

WAR IN THE AIR

ENEMY AIR LOSSES TO MAR. 11th

	Over G.B.	Continent	Middle East	Italy
Mar. 5 ...	1	5	4	0
" 6 ..	0	2	4	0
" 7 ..	0	2	0	5
" 8 ..	0	0	2	6
" 9 ..	0	0	0	2
" 10 ..	0	4	0	1
" 11 ..	0	0	0	36
	1	13	10	50

Totals : West, 8,053 ; Middle East, over 5,843 ; N.W. Africa and Italy, 4,704.

The R.A.F. has long wanted to stage a campaign against that branch of German war industry, but there were difficulties. In the middle of 1942 the Germans saw the shadow of coming events, and reorganised their aircraft industry. For instance, specially important factories were often located outside the towns, and it was not feasible for the night bombers to make sure of hitting them. They could only be certainly destroyed by day ; and by day the R.A.F. heavy bombers could only rarely venture out, when they reckoned they could take the enemy by surprise. Daylight attacks were necessary to do the job thoroughly, and that meant fighter escorts. The Americans have now worked up the technique of daylight raiding to a pitch of great efficiency, and the R.A.F. has left that side of the war to them. Night raiding is the speciality of Bomber Command, and no other force in the world can rival it in its experience and mastery of that particular art.

In addition to destroying Germany's fighter factories, it is very desirable to destroy her existing fighters. By night our bombers cannot hope to shoot down many of them. Wholesale destruction can only be accomplished by day, and by a force of escort fighters. The *Luftwaffe's* fighter squadrons must go up to oppose any raid by large forces of heavies, whether by day or by night. By night they can expect to suffer only moderate casualties, but by day very heavy losses have to be faced. For this reason, among others, the American 8th Air Force has lately been delivering blow after blow. It has forced the Germans to fight. To use a term from the card table, Gen. Spaatz has been leading out trumps. He suffers losses, but he can afford them, and he knows that the *Luftwaffe* is getting near the verge of bankruptcy. It is not bankrupt yet, but it sees the danger signal ahead. It does not want to fight, but it must.

So it has come about that the only Allied fighters which the Berliners have seen over their city have been American. There is absolute agreement between the U.S. and Britain about the use of resources, and the latter has agreed cordially to letting the supply pool specialise on providing Gen. Spaatz with escort fighters.

The results of this policy have lately come prominently into notice. The number of fighters which have risen to challenge American raids has been notably diminishing, and last Saturday not a single American bomber was lost in a raid on Münster. Next day Liberators went over the Pas de Calais and struck at the military objectives there without any fighter escort at all. There was no enemy opposition, and all the Liberators returned safely.

CAPITAL PUNISHMENT : Flying Fortresses of the 8th U.S.A.A.F. pass through the dense A.A. barrage over Berlin.

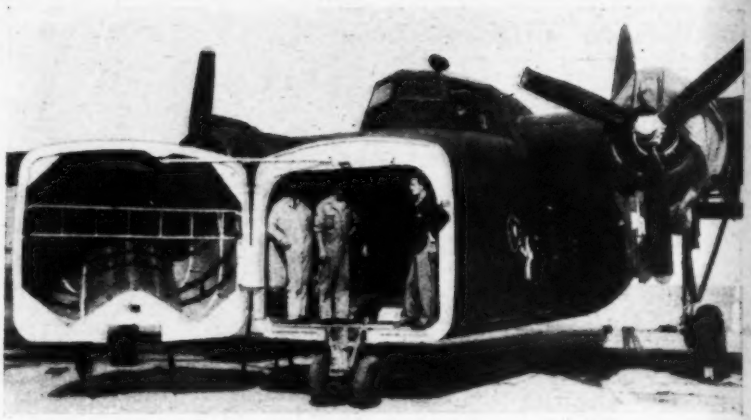
BRITISH & U.S. AIR LOSSES TO MAR. 11th

	Over G.B. A'cft.	Continent B'brs.	Continent F'trs.	Middle East A'cft.	Italy A'cft.
Mar.					
5	0	5	5	3	0
6	0	63	12	4	3
7	0	2	1	0	4
8	0	38	19	2	9
9	0	7	2	0	1
10	0	1	0	0	5
11	0	0	5	0	11
	0	121	44	9	36

Totals : West, 10,382 ; Middle East, about 2,386 ; N.W. Africa and Italy, 1,786.

CONCENTRATED PERSUASION : Loading one of the new 12,000 lb. bombs into the racks of an Avro Lancaster. The largest bomb used in the last war weighed 3,300 lb.

HERE AND THERE



LOW AND BEHOLD: A level loading floor only 36in. from the ground, and a fully hinged nose are two highly convenient features of the Curtiss Caravan (two 1,200 h.p. Twin Wasps) transport built of wood. Square section monocoque fuselage gives maximum stowage space.

Sir Miles Thomas Honoured

THE Court of Governors of Birmingham University, at their yearly meeting recently, elected Sir Miles Thomas, D.F.C. (Vice-Chairman of the Nuffield Organisation), a Life Member of the Court.

Canada Has 12,000 Trainers

MR. C. G. POWER, the Canadian Air Minister, has reported to the Canadian House of Commons that Canada has nearly 12,000 aircraft in air training operations and proposes to accept delivery of another 2,000.

He said that the present R.C.A.F. strength is 206,702, including women.

Secret Weapon?

A FLIGHT SERGEANT in a Spitfire, after chasing a German raider back to France, returned to his base and, next day, fell ill with German measles.

These Jerries will jettison everything to escape from a "Spit," won't they!

No Secret Now

OUR contemporary, *American Aviation*, takes upon itself, in its Jan. 1st issue, to "release" news of two new British fighter aircraft from the secret list, namely the Vickers-Armstrong Windsor and the Hawker Tempest.

They were mentioned in an article dealing with comments made by Wellwood E. Beall, of Boeings, upon his return to the U.S.A. from a visit to American air bases in England; Mr. Beall also visited a number of British aircraft factories, including the two mentioned.

Death of Roy Brown

CAPT. ROY BROWN, who gained international fame in April, 1918, by shooting down Baron Von Richthofen, the German flying "ace," who was claimed to have accounted for 80 Allied aircraft, has died on his farm near Toronto. The story goes that Brown, then a young second-lieutenant, did not learn until some time afterwards that his "bag" was the leader of the notorious "Richthofen Circus."

The greater part in Richthofen's victims were slow two-seaters.

To Strengthen B.O.A.C.

THREE new assistant directors-general for B.O.A.C. have been appointed by General Critchley, director-general of the corporation; they are Mr. A. F. Burke (technical services), Mr. J. B. Beck (administration), and Mr. R. D. Stewart (commercial).

Lord Knollys, chairman, and General Critchley recently completed a tour of B.O.A.C. world routes and decided that some strengthening of the organisation at home and abroad was necessary.

C.P.A.'s 1943 Figures

EVERY day during 1943 Canadian Pacific Airlines aircraft carried 239,717 air mail letters, 196 passengers, and 25,998lb. of air cargo, according to figures issued by their president, Mr. L. B. Unwin. A total of 71,696 passengers were carried, as well as 2,197,417lb. of mail and 9,489,417lb. of air cargo during the fiscal year ended December 31, 1943. The air mail letters are estimated at 40 to the pound.

Passenger traffic during 1943 increased 24 per cent. and mail carried showed a gain of 28 per cent. There was a minor decline of one per cent. for air cargo handled. At the same time, the increased utilisation of C.P.A.'s services is reflected in the passenger miles flown.

Intelligent Anticipation

WHAT is believed to be the first order for a company's aircraft for post-war delivery has been placed by Capt. A. G. Lamplugh, of the British Aviation Insurance Co.

It is to be a civil version of the Miles M-28 three-seater communications type, powered by a Gipsy Major Series III engine fitted with c.s. airscrew, and its equipment will include a new type of G.E.C. lightweight radio set specially developed for private owners' use.

Gent's Natty Suiting

THE R.C.A.F.'s newest flying suit—a two-piece protective garment designed after experiments involving 4,155 members of air crew—has recently been displayed for the first time in an exhibit of official R.C.A.F. photographs and fighting equipment in a Toronto office.

The suit features a number of zippers which eliminate bulkiness and enable the wearer to remove the suit in 15 seconds in event of fire, waterlogging, or other emergencies. Three-piece gloves and goggles framed in a sponge rubber pad complete the outfit, known as the type E flying suit.

For Posterity

SCALE models of a Hampden and a Halifax II were presented by Sir Frederick Handley Page to Mr. S. M. Bruce, the High Commissioner for Australia, at the Boomerang Club last week. They are destined for the National War Museum in Australia, where, said Mr. Bruce, they will be of intense interest to coming generations of Australians.

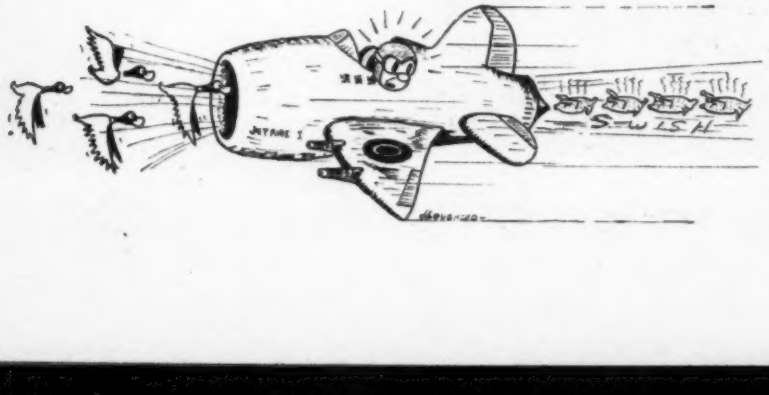
Sir Frederick, in making the presentation, recalled an amusing comment made some time ago by Lord Brabazon during a discussion on how flies manage to alight upside-down on the ceiling.

"Yes, it's a wonderful bit of flying," observed Lt. Col. Moore Brabazon, as he then was, "but Australian airmen down under are doing it all the time."

Veteran Warplanes

SOME weeks ago the Air Ministry released a story about a Spitfire that had flown so many operational hours that it had acquired the nickname of "Grandpa." Now come two more stories of veteran warplanes—a Lancaster and a Swordfish.

The Lancaster, "G for George," made its eighty-first operational sortie over enemy territory last week; it belongs to an R.A.A.F. bomber squadron operating from Britain. The Swordfish, No. 7673, will have completed no less than six years of service with the Fleet Air Arm by



HERE AND THERE

next month. This gallant Swordfish has flown 1,200 hr. in various theatres of war, and is now to be converted for target towing—Old Stringbags never die!

Not "Money to Burn"

A RED CROSS Penny-a-Week Fund collecting box was one of the few things salvaged from a London factory damaged in a recent fire-raising air raid. The box, battered and burnt but still full of pennies, was recovered by Mr. W. Gardener, the manager, who is a voluntary collector for the Fund.

Maori Fighter Pilots

MAORI fighter pilots are flying with "Cobber" Kain's old squadron in Italy, said an official New Zealand war correspondent's despatch, quoted by *Reuter*, a few days ago.

One of them, Flt. Sgt. E. M. Karatau, the first Maori Spitfire pilot, has flown dozens of sorties over the Anzio beaches and across the Adriatic to support Marshal Tito's forces in Yugoslavia.

G.A.P.A.N. Activity

THE new Deputy Master of the Guild of Air Pilots and Air Navigators of the British Empire is to be Air Vice-Marshal D. C. T. Bennett, D.S.O., C.B.E., the celebrated Chief Pathfinder of Bomber Command, and a full list of their officers and court will soon be announced.

The Guild, which hopes soon to have offices in the West End of London to replace their home, which was "blitzed" in 1941, has decided to restore the pre-war three-guinea subscription rate for all professional members as from September next. Service personnel may enrol as temporary associate members at one guinea per annum, but those joining now need only pay 10s. 6d. until September 30th.

February Record

MR. CHARLES E. WILSON, chairman of the U.S. Aircraft Production Board, has announced that 8,760 aircraft were accepted from the American aircraft industry in February. This number is approximately the same as in recent months, and represents another period in which production was ahead of schedule.

The rate of output per day in February reached 350, compared with the previous record of 339 planes per day. The weight of airframes produced, which measures productive effort, was 4 per cent. above the January figure—namely, an increase from 90,300,000 lb. to 93,500,000 lb.

Again, the largest acceleration was in tactical types. This group (which includes fighters, bombers and cargo planes) formed 84 per cent. of the February total.

Our Own Trumpet

FIGURES showing the gigantic output of aircraft in the U.S. are issued so regularly that it was time a little healthy publicity was given to our own efforts, and the recent statement by Mr. Oliver Lyttelton, Minister of Production, was, therefore, particularly welcome.

The total of 90,000 aircraft, mostly combat types, was impressive, but what was more important for the world to know was that more than three-quarters of the total structure weight of new aircraft delivered to the R.A.F. and F.A.A. during 1943 was produced in Great Britain, and heavy bomber structure alone showed a weight increase of 33 per cent. for last month compared with February, 1943.

Cost of Air Travel

IN a paper by Mr. D. H. Handover, formerly of B.O.A.C., read recently to the Cambridge Conference of Geographical Associations, the author stated that the cost of operating a four-engined aircraft from London to New York would to-day be in the neighbourhood of £2,500, and the maximum load on such a journey would be round about 3½ tons.

Assuming that this referred to payload, it puts the actual *cost* of passenger transport at something like £65 to £70 per person for the single trip. Actual fares, therefore, would have to be still higher, unless substantially subsidised.

Fares very much lower than this for the *return* trip have been confidently forecast by American interests, while Capt. McIntyre, addressing Canadian Service men in Glasgow (see "Here and There," *Flight* December 9th, 1943), expressed the opinion that a £50 return fare between Britain and U.S. would be operating very soon after the war.

NEXT MAN IN: The "Batsman" on the *Illustrious* snapped while signalling to aircraft landing-on. (Top) "Too fast, go to starboard." (Centre) "Far too much to starboard." (Bottom) "Come in as you are." Only officers with considerable experience of deck-landings are entrusted with this responsible job.

Maharajah's Gifts

HIS HIGHNESS AIR COMDRE. THE MAHARAJAH OF JODHPUR has made a donation of three lakhs of rupees for Air Force welfare, one lakh each to be given to the Benevolent Funds of the R.A.F. and Indian Air Force and one lakh for Royal Air Force and Indian Air Force amenities in India.

A lakh is 100,000 rupees, or £7,500 at the present rate of exchange.

This magnificent gift follows a gift of £500 which the Maharajah made to the R.A.F. Benevolent Fund in April, 1940, and a further gift of one lakh of rupees to be divided equally between the Benevolent Funds of the R.A.F. and the Indian Air Force which was made by the Maharajah on the occasion of the R.A.F. Silver Jubilee in 1943.

Alaska Air Route

IT was announced last week that Canada is taking over U.S.A. interests in the North-West air route between Edmonton, Alberta, and Alaska, one of the most important routes in the world, both in relation to the war against Japan and subsequently as part of the international air route.

Total wartime cost of improving the route is estimated at nearly £15,000,000.

Mr. Clarence D. Howe, Minister of Munitions and Supply, said in the Dominion House of Commons: "In arranging post-war use of the route, Canada will pursue a liberal policy of co-operation with other nations.

"We hope the use of this route will become part of a general scheme of international co-operation on air transport matters which will provide greater freedom of movement of aircraft traffic within a suitable international framework."

Safe Conduct Given

THE first Swedish civil air liner to fly between Sweden and Britain since one was shot down by the Germans last October recently arrived in Scotland, certain "technical difficulties" in arranging safe conduct, to which we referred in *Flight* of March 2nd, having been overcome.

There was only one passenger, the Air Attaché at the Swedish Legation in London. The remaining space was filled with accumulated mail.

"The plane flew with lights full on," says the Press Association report, "and with small searchlights on the wing-tips directed on to the body, painted orange and bearing the Swedish air registration letters."

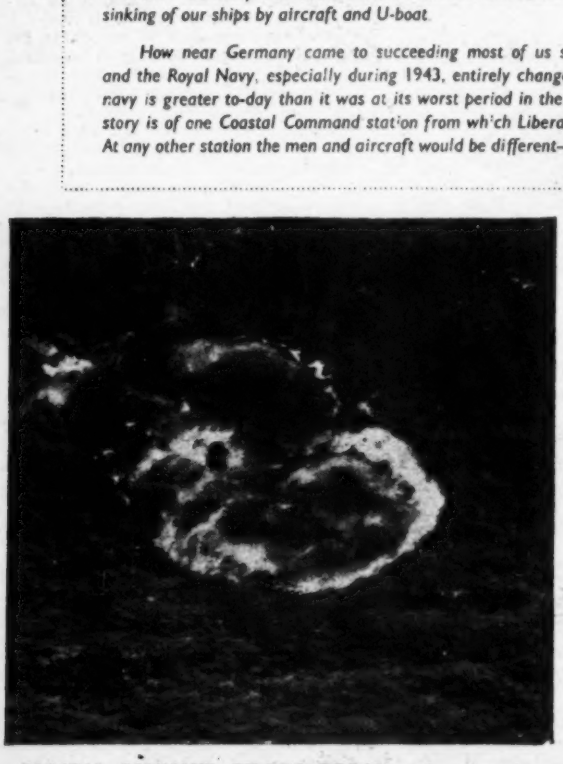
"Safe conduct has been given by agreement between Sweden and Britain and Germany," an official of the Swedish Airline in London told a P.A. reporter, "and so the service between Sweden and Britain has been resumed."

D

U-boat Menace Largely Discounted : Another Definite Win for the R.A.F. over the Germans

THE Battle of the Atlantic, that epic struggle in which there was no "phoney" period at the opening of hostilities in 1939. Germany intended to make no mistake this time. England was to be starved of food and supplies by the constant sinking of our ships by aircraft and U-boat.

How near Germany came to succeeding most of us sensed at the time, but the great work of Coastal Command and the Royal Navy, especially during 1943, entirely changed the picture. The rate of loss of submarines by the German navy is greater to-day than it was at its worst period in the 1914-18 war when the crews refused to man the boats. This story is of one Coastal Command station from which Liberators range over the whole eastern half of the North Atlantic. At any other station the men and aircraft would be different—the story would be the same.



COASTAL COMMAND PILOT'S DREAM: A submarine blowing its tanks and rising to the surface under the aircraft

THERE seems to be little doubt that 1943 will go down in history as the year in which the tremendous Battle of the Atlantic was finally decided in favour of the Allies.

At times the U-boat packs hunting our convoys came near to strangling our lifeline of munitions and food across the sea. We still do have some shipping losses, but they scarcely represent one-tenth of the losses we suffered in 1942. This despite the fact that we have many more bottoms at sea at any one time.

To make up for this falling-off in results the enemy has, during the past few months, tried to supplement the efforts of his U-boats by using He 177s, Ju 290s and Fw 200s equipped with the comparatively new radio-controlled Henschel 293 glider-bombs. The chief advantage of these is that they can be released at a distance of about 6,000 yards. This enables the aircraft to keep out of range of the light A.A. gun umbrella of the convoy. Only the heavy stuff can function satisfactorily at this range.

For a while these attacks were somewhat disconcerting, but our patrol aircraft, and fighters flown off the baby "flat tops," now have the measure of this rather unwieldy form of attack.

How has all this been achieved? In part it is due to improved detection technique; in part it is due to more and better escort vessels, including the escort carriers. More than anything else, however, it is due to the unceasing

NO QUEUEING : Tunny fish lying dead on the surface after a depth charge attack

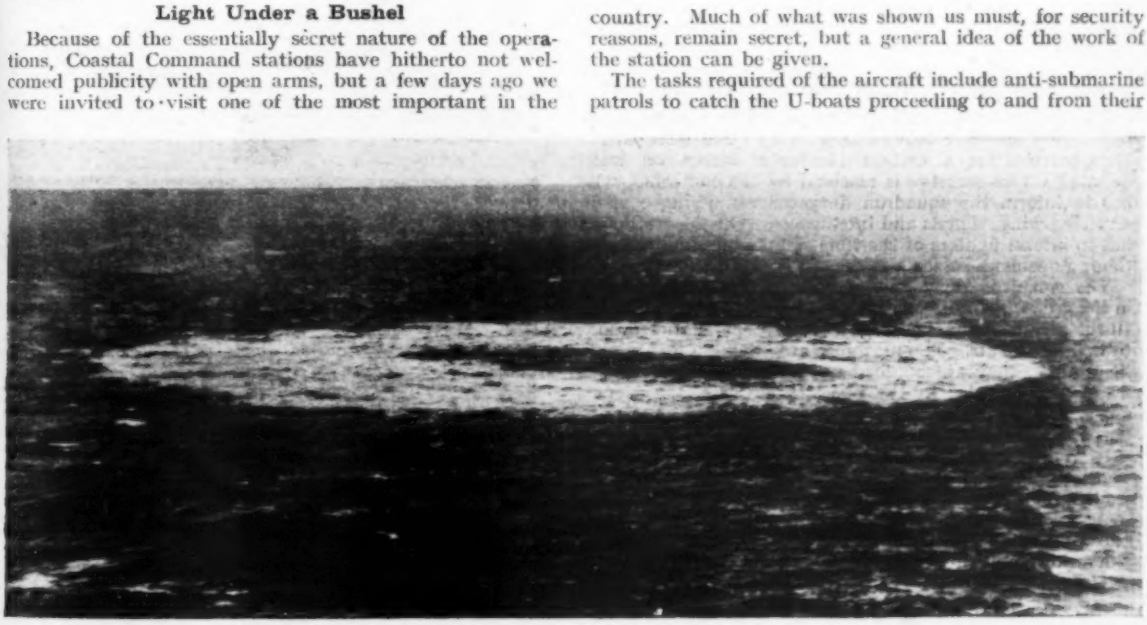
Depth charges from a Short Sunderland envelop a German U-boat

long-range day and night patrols, carried out in fine or foul weather over thousands of square miles of ocean, by the aircraft of Coastal Command. Range has ever extended. Our Ansons used to fly in the direction of the Bay of Biscay, and felt themselves a long way from home when off Ushant. The Liberators of to-day, with 2,600 gallons of fuel on board, can patrol half-way across the Atlantic or spend hours over the Bay of Biscay, and, if the weather turns "dud" at the home station, they can be routed to land at Gibraltar, the Azores or in Northern Ireland.

Light Under a Bushel

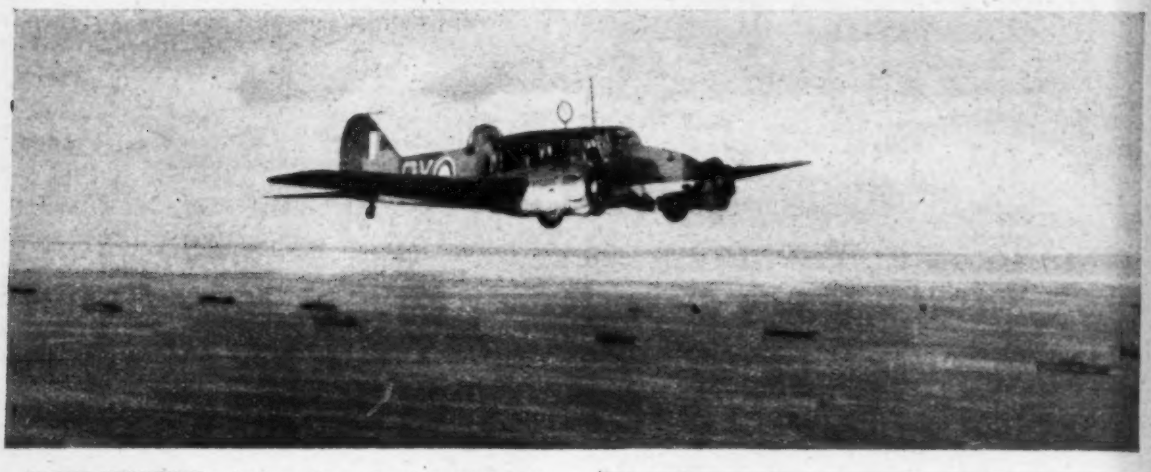
Because of the essentially secret nature of the operations, Coastal Command stations have hitherto not welcomed publicity with open arms, but a few days ago we were invited to visit one of the most important in the country. Much of what was shown us must, for security reasons, remain secret, but a general idea of the work of the station can be given.

The tasks required of the aircraft include anti-submarine patrols to catch the U-boats proceeding to and from their



OIL ON THE LESS TROUBLED WATERS : The tell-tale ring of fuel oil on the surface as it rises from a sunken submarine.

COASTAL COMMAND STATION



IN THE BEGINNING : An Avro Anson keeping watch over a convoy in the early days of the war. The Anson did a first-class job of work and is now used extensively for training

bases ; anti-submarine escort of convoys, and anti-shipping patrols. This last is particularly directed against enemy blockade runners trying to bring in their precious loads of tin and rubber.

To meet these requirements there are at the station we visited both day and night squadrons. The latter use the Leigh light, which has so recently emerged from the shroud of secrecy. For the very long-range work there are white-painted Liberators which can take a sixteen-hour patrol in their stride, and can do more if necessary.

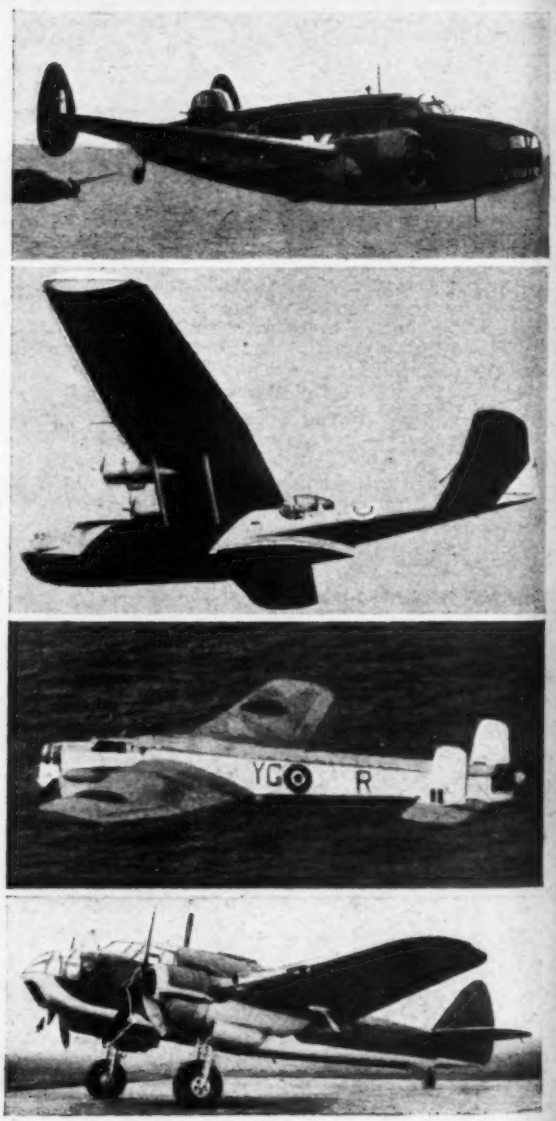
As will be realised, this means that an enormous amount of maintenance has to be done. This is undertaken by a servicing wing. The wing is subdivided into sections dealing with armament, engines, airframes, cameras and wireless. In all departments a considerable proportion of W.A.A.F. personnel is employed in addition to the male staff. There is also a large operational staff, which includes operations officers, intelligence officers, signals and flying control.

From Group to Aircrew

The orders for operations are passed in the following sequence: The first move comes as an order from Group Headquarters for a certain number of sorties on tasks detailed. This message is received by the controller, who has to inform the squadron duty officers, flying control, servicing wing, signals and intelligence. Off the station he has to inform fighters of the time of take-off, etc., through their movement liaison officer.

The squadron duty officers arrange transport to bring in the crews, many billets being as far away as seven miles. In the meantime hot meals are being prepared and rations to take in the air. The machines are having a last-minute inspection ; they are bombed up and armed and cameras fitted and tested. In the operations block the signals officer is preparing his signals information which has to be carried in all aircraft, and the Intelligence Officer is preparing his briefing.

All the latest orders are checked and noted ; the order from Group Headquarters is scrutinised for last-minute instructions and for the area and purpose of the sortie. A check-up of all the aircraft in the area is made, and consideration is given to the enemy order of battle to decide



SOME COASTAL TWINS : Reading from the top downward : Lockheed Hudson, Consolidated Catalina, Armstrong Whitworth Whitley and the Bristol Beaufort

COASTAL COMMAND STATION

The Boulton Paul rear turret on the Liberator has four 0.303in. machine guns ; the Bendix electric dorsal turret is equipped with two 0.5in. machine guns.

YANKS IN COASTAL. The Boeing Flying Fortress and the Consolidated Liberator are both suitable for ocean patrol because of their long range

what types of enemy aircraft are likely to be met in the area. If it is a convoy job or anti-submarine sweep, available information regarding the presence and position of any U-boats is also noted. Our own shipping is plotted on the board by the duty plotter, and is checked by the duty intelligence officer, who decides what shipping particulars are necessary for the sortie in question, always bearing in mind the length of the sortie as well as its location. The duty plotter notes the time the aircraft has to be on patrol, and plots back to find its take-off time, using the meteorological information available. The duty met. officer prepares his forecast—a very comprehensive document.

About three hours before take-off time, the crews assemble in the operations room annexe and are called in for briefing. The duty intelligence officer explains the job, which by this time has been plotted in thread on the situation map and also written up on the patrol board. He then goes on to his briefing, points out any instructions included in the orders, reminds the crews of points in procedure, and running over the salient points of standing instructions. Our own shipping, as plotted is reviewed. The U-boat situation and enemy aircraft situation are explained, and this part of the briefing usually ends with a few questions by the intelligence officer to members of the crews, and questions by the crews regarding points on which they may be puzzled.

In addition to the excellent work done for Bomber Command, the Handley Page Halifax has been used extensively by Coastal Command

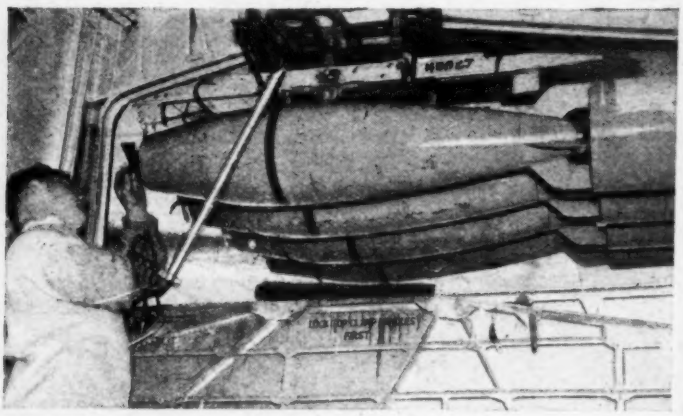
When and How

When these have been disposed of the duty signals officer takes over. Roughly the position is that whereas the intelligence officer tells the crews when and in what circumstances they send signals; the duty signals officer reminds them how and on what frequency, etc. The met. officer finishes the briefing, giving details of weather at base and in the area, and possible conditions on return.

The crews then collect their "gen" folders containing reminders on procedure; they also collect recognition signals and boxes of rations. When the captains are satisfied that everything is in hand the crews go to the aircrew mess for a meal.

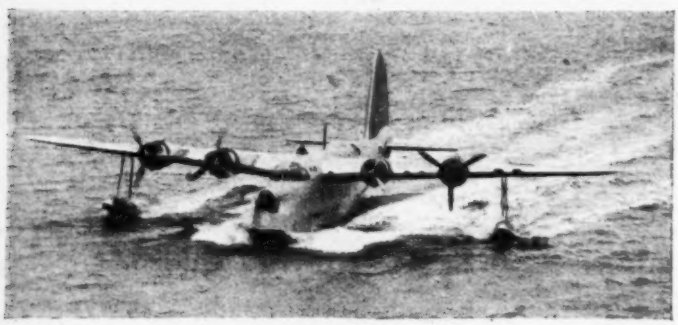
About an hour before take-off time the crews

COASTAL COMMAND STATION



(Above.) Anti-submarine bombs on the internal racks of a Short Sunderland. When required for use the whole rack slides out on guides under the wing

(Above.) The Bristol Beaufighter X, which carries a torpedo in addition to its usual armament of four 20 mm. cannon and six 0·303in. machine guns. (Left.) The Short Sunderland has been in service for the whole of the war. This photograph is of one of the earlier types before sleek outlines were spoilt by camouflage



are transported to their aircraft and proceed to settle themselves down and to make a final check of all the gear. The engines are started, warmed-up and run, and all gauges are examined. When all checks have been made the aircraft taxi out to a convenient point near the down-wind end of the runway in use, there to await instructions from flying control. Every effort is made to take off within a minute or two of the time laid down, as a late take-off by one machine might well upset a carefully planned operation.

When the signal is received the aircraft takes off. In a large aircraft this is a complete operation. The efforts of several members of the crew are needed before the sixty-odd thousand pounds of machinery, men and bombs roar into the air. Once the machine is airborne, a circuit of the airfield is made, gauges and dials finally checked and read, and the aircraft then sets course for its patrol area. It will be about fourteen hours before that crew is once more on land, or usually even over land.

Quite obviously boredom is a greater enemy to Coastal Command than are the Germans. Imagine watching the clock hands making more than a complete circle while a patrol is carried out on an inky black moonless night, far out over the Atlantic Ocean.

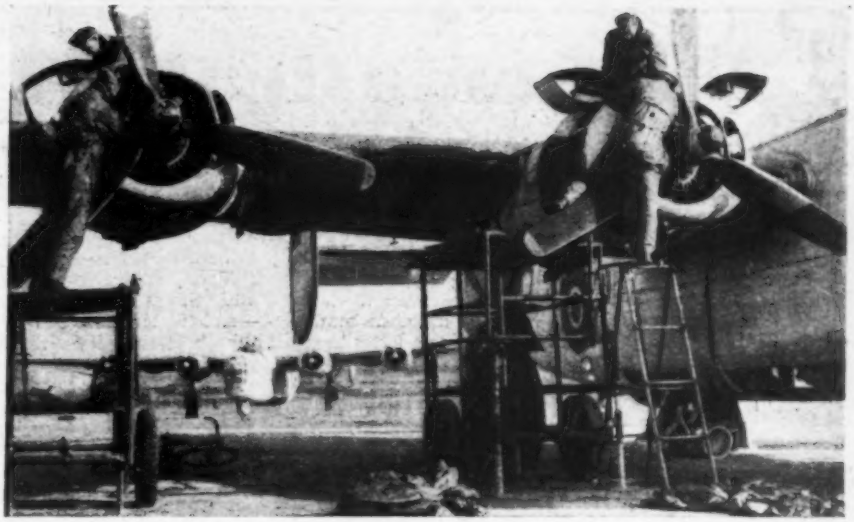
It is interesting to find the reaction of the aircrews to these long spells. A rear gunner we spoke to said he occupied his mind by visualising the situation map in the operations room and continually placing himself in relation to the thread representing his patrol as he saw it last. A pilot said he had difficulty in keeping his eyes in focus as the hours of patrol dragged on. Certainly, a number of the fellows as we saw them, recently returned from patrol, did look rather bleary-eyed.

Another complaint was that a Liberator flown with the automatic pilot in operation is very unpleasant in bad weather. Not that there were any complaints about the automatic pilot doing its job properly. All the pilots were

A D.H. Mosquito of Coastal Command shoots down a Heinkel 115 over the Norwegian coast. The crew of the Mosquito are Norwegians

enthusiastic about the Minneapolis Honeywell "George." One of them—a squadron leader who sported a D.S.O., D.F.C. and Bar—told us that he once flew for 14 hours on seven different courses without disengaging the automatic pilot. It is a feature of the Minneapolis Honeywell instrument that turns of any selected degree can be made by presetting a single pointer.

Operational losses on such hazardous work are always liable to occur, but flying accidents are few and far between. One of the squadrons, for instance, has now been operating for seven months without a flying accident, and 11 months without any aircrew being hurt in a crash.



Liberators in the hands of the ground staff at a Coastal Command station

On the face of it one would expect these big four-engined Liberators to be at the mercy of any Ju 88 they were unfortunate enough to meet. Not a bit of it. On one occasion a Liberator fought eight Ju 88s for an hour and a half, shooting down one, damaging another and eventually getting back to base with only one bullet hole to show for the encounter. On another occasion a formation of Ju 88s attacked a single Liberator which was only 1,000ft. above sea level at the time. The Lib, which does something over 300 m.p.h. with the "taps full on," promptly climbed for a patch of cloud at 10,000ft. Arriving there with the enemy hot-foot after him the Liberator did a stalled turn straight into the Ju formation, a manœuvre which upset both their aim and their calculations.

When several of our aircraft were attacking some enemy ships a curious accident occurred. The wing of a Liberator hit the high-aspect-ratio tail of a Wellington. The Wimpey lost the top of its fin and rudder, and the Lib. lost 13ft. of outer wing. By using full trim, full aileron and nearly full rudder, the Liberator pilot managed to keep his machine on an even keel. He even managed to climb up to 5,000ft. Fearing that oil and fuel pipes might be broken, he switched-off the outboard engine and feathered the airscrew for some five minutes; after that the engine was re-started and functioned perfectly all the way back to base. A particularly interesting feature of the waywardness of this damaged aircraft was the fact that when the flaps were lowered for landing, the aileron control—what there was of it—had to be reversed. All this happened at 6.45 a.m. on Christmas morning 600 miles out to sea. The journey back took some four hours.

From the foregoing it will be obvious that the standard of pilotage in Coastal Command is very high. Second-tour pilots with about 500 hours to their credit are considered to be the most suitable, but even so a lot of training has still to be done. It is scarcely fair to pick out the pilots for special mention because the wireless operators and air gunners must keep up their careful vigil for long hours while, of course, the aircraft and its whole crew are dependent on the navigators' (the Liberator carries two) careful work for their safety.

The aircrews deserve all the glamour attached to their job, but what of all the devoted work done by the ground staffs to make the operational flights possible? Even changing a set of plugs at a dispersal point in January, with a north wind blowing, is a poor idea of amusement. But how can we give a fair meed of praise to all the people in Coastal Command who deserve it—the photographers, W.A.A.F., electricians, riggers, fitters, signals, armourers, instrument makers and a host of other trades? We can only do it by quoting results. *During* 1943 *comparatively few ships were sunk in the Atlantic within* 800 *miles of our bases, and, to quote the First Sea Lord, Mr. A. V. Alexander, the rate of loss is now less than one ship in a thousand.* That is sufficient to make any member of Coastal Command proud and satisfied with the job he or she is doing

STRATOSPHERIC TWO-STROKE. The Junkers Ju 86P high-altitude reconnaissance-bomber is powered by two Junkers Jumo 207A two-stroke engines in which opposed pairs of cylinders and pistons share a common combustion space. Turbo-supercharging gives a service ceiling of 45,000ft. and a pressure cabin is employed. Three Ju 86P's were shot down in the Mediterranean by Spitfires at over 40,000ft.

Indicator Discusses Topics of the Day

Mathematical Myopia

Blinding by Science : Theoretical Perfections Against Practical Values : Gliding Speeds and Distances : More Muddled Thinking

LONG ago I regretfully came to the conclusion that people in general were far too easily blinded by science and, in particular, by formulæ and statistical figures. Anybody can prove almost anything by reference to statistics—mostly phoney—and the sight of a lot of mathematical formulæ in a book, or an article, or a letter in the correspondence pages, reduces the average person to overawed silence. An enormous amount of nonsense is let past by otherwise intelligent people who have this "figure complex."

Anybody can try it out quite easily and with huge success on a bunch of people engaged in a general conversation. Let there be disagreement, for instance, on the subject of flying training or medical research; all you have to do in clinching an argument is to say: "Do you know that 72.37 per cent. of the flying accidents in this country are due to overshooting?" or: "Are you aware that no fewer than 38.69 per cent. of the deaths from disease in this country last year were the result of initially incorrect diagnoses?" and all your opponents fade out immediately. The two figures after the decimal point are the telling ones; it's no use saying, "about thirty per cent." or "about one-third." Of course, the trick shouldn't be used too often, or amongst very professional people, or unless one is certain of one's own essential rightness. If the trick is used too often one becomes suspect; amongst experts there is bound to be at least one who knows the right answer; and unless you're sure of yourself you cannot possibly give the right degree of emphasis and conviction.

Because of this human weakness I think the greatest danger to which the race is subject is that of being dominated by the so-convincing theorists and consequently being moulded into a new and unhappy shape, or that of having the social and industrial structure re-made so "perfectly" that nobody will ever again be happy.

Building to Formula

The danger can be seen everywhere. Just look at all the "world's best aircraft" nonsense. One day the Powers That Be may get hold of a formula which strikes their fancy, and so decide to build only those military or civil aircraft which reach top figures. And in nine cases out of ten the decision would be an utterly wrong one, because no allowance would be made for the opinions and preferences of the crews who have to fly them, or of the passengers who are to be carried.

It would not be too much to say that the success of certain military types in this war has been the result rather of good inherent characteristics than of sheer performance as such. If the Spitfire or the Hurricane, for instance, had been less good as fighting machines, their pilots would still have done well if they'd liked flying them and been confident in their structural strength. The pilots would, in fact, have done better even with inferior types than with uncomfortable and dangerous devices with a startling performance.

At least one remarkable day bomber is likely to disappear from use because its take-off and near-ground handling characteristics are more than can be reliably coped with by the average pilot. Nobody imagines that the British heavy bomber would have done such good work if the load-carrying capacity had been obtained at the expense of good handling qualities or ease of operation or simplicity of maintenance—all qualities which cannot be given a fair figure in any formula. Wing loading, for instance, offers no criterion of manœuvreability; there are bad aircraft with low wing-loadings and good aircraft with quite phenomenally high loadings. Formula figures would have to be included for control weight, the crew's move-about-ability, stability in cloud-flying conditions, and a host of other things if any sort of fair comparison was to be made—and the test pilot and/or the squadron pilot would scrub the whole thing if he just happened not to like the machine very much!

In just the same way figures can be used to support the most cock-and-bull statements about aircraft handling—and some shocking *faux pas* are made daily by people who should know better—myself no doubt included from time to time. I hadn't been following very closely the correspondence in *Flight* a few weeks ago about gliding speeds and distances, but I did see one or two extraordinary statements

Time and Distance

There didn't, at the time, appear to me to be anything very difficult or abstruse about the problem, whatever it was. Every aircraft has its most "economical" gliding speed in matters of time and distance, and this speed differs according to the all-up weight. Obviously a heavily-loaded aircraft has a higher stalling speed, a higher "sinking" speed, and, consequently, a higher "economical" gliding speed. Other things being equal, an aircraft with no load will stay in the air longer because its wing-loading is lower and its gliding angle flatter. The faster it is flown above the optimum figure, the greater will be the necessary drag and the sooner it will reach the ground.

If the mass of air in which one is flying happens to be moving at, say, 30 m.p.h. in the same direction, it will obviously pay one to keep as near as possible to the best figure; if it is moving in the opposite direction then, after a series of calculations in time and distance, it *might* be found to pay to be prepared to reach the ground a little sooner (the result of increased drag in the ordinary way), but, consequent on the increased ground speed, a little farther on. One can so easily quote the extreme case of the light aircraft in which the best gliding speed happens to be the speed at which the air, on that day, is moving; in order to land anywhere but on a spot immediately underneath, it will be necessary to fly faster and to lose flying time but gain distance.

It's all rather like the old handicapping problems in peacetime air racing. Unless the handicappers allowed for the average strength of the wind on the day of the race, and there happened to be half a gale blowing, the slower machines would be right out of the race—simply because they spend so much longer (at a low ground speed) covering the up-wind legs of the course, while not spending proportionately longer on the down-wind legs.

The Moving Medium

The great thing is not to consider whether an aircraft is flying up-wind or down-wind, but to treat it as flying quite normally, at its usual speed, in a mass of air which happens to be crossing the country at a certain speed. Unless it is near the ground—and consequently affected by gusts and ground-deflected masses of air—wind speed and direction haven't the slightest effect on an aircraft's flying characteristics or its various "economical" speeds except in so far as the time factor enters into the problem. Perhaps it would be better still for the "argifiers" to imagine the aircraft flying along while some strong and important chap shifts the earth bodily along while the pilot isn't looking; that's all that happens in effect, and it becomes a nuisance and a matter for furious calculations

MATHEMATICAL MYOPIA

only when the ground is being shifted away nearly as fast as the aircraft is travelling in its own medium.

Which reminds me that I was mildly shot down by a correspondent after my last chatter—many months ago—about various common up-wind and down-wind illusions. He said that ground bumps *do* kick the aircraft round its "inertial" axis, and I'm quite prepared to agree with him. In fact, in the article itself I suggested this as a possible cause for near-ground peculiarities which were not otherwise explicable, but my main contention was that in a "perfect" wind no such peculiarities would be possible, and that until the aircraft touched the ground the fact that the mass of air *was* moving along would not be noticed by a pilot who couldn't actually see the ground.

Since then I've made some more experiments in cross-wind approaches with an aircraft in which the rudder is slightly overbalanced and which is inclined to be directionally unstable or "neutral." Coming in to a runway with no near-by obstructions and in a "smooth" wind I would defy any duly hooded expert to notice the difference, but on one day, arriving to leeward of some buildings in a very rough wind, the darn thing certainly twitched into wind once or twice. To make quite sure, I had left my feet on the floor until the last moment, and I could actually feel and see the gusts kicking the aircraft, though its desire to fly straight (so far as its "own" air was concerned) damped the kicks out very quickly, and I doubt, even then, if the twitches would have been noticed without visual assistance.

And that is just one more example of flesh-and-blood versus the theorists. I was (and am) dead right as far as a "perfect" world is concerned, but I spent very little time allowing for the irregularities of winds as they really are near Mother Earth, where nothing is symmetrical and nothing is perfect. I still claim that most of the supposed "weathercocking" is man-made in a passion for keeping the aircraft's approach line matched up with the runway.

"INDICATOR."

EXCLUSIVE NEWS!: Air Marshal Sir Arthur Coningham, who now commands the 2nd Tactical Air Force in Britain, has brought his famous caravan back to this country. He has had the caravan with him all the way from El Alamein.

A.T.A. BENEVOLENT FUND

SOME further donations to this worthy fund have been received since publication of the last list in the issue of January 27th. This brings the total up to March 7th:

	£	s.	d.
Already acknowledged	8,688	18	7
Subscriptions by members of A.T.A. and B.O.A.C.	2,775	17	1
Bullers, Ltd.	15	15	0
General Trading Co., Ltd.	3	0	0
Flt. Lt. H. Kennedy, R.A.F., India	2	0	0
K. Bilham (Balham, S.W.12)	10	0	
Anonymous	10	0	
A. Sarll	5	0	
	£11,486	15	8

"CANNONBALL" AIR SERVICE TO BURMA

PAN-AMERICAN AIRWAYS are now operating a two-ocean and four-continent airline 11,500 miles long to rush supplies to General Stilwell's forces in Burma. Operating under contract to the Army Air Transport Command, Pan-American Airways work to close schedules and make the round trip between Florida and North India in 180 hours.

Called the "Cannonball" Service, the aircraft have set a record of more than 2,200 Transatlantic flights and logged more than 14,500,000 miles for the Army since November, 1942.

THE PRESTWICK "PANIC"

MR. BRENDAN BRACKEN, M.o.I., did his best recently to correct some common misconceptions about "security" and its application to Prestwick airport. It would be agreeable to believe that the object has been achieved.

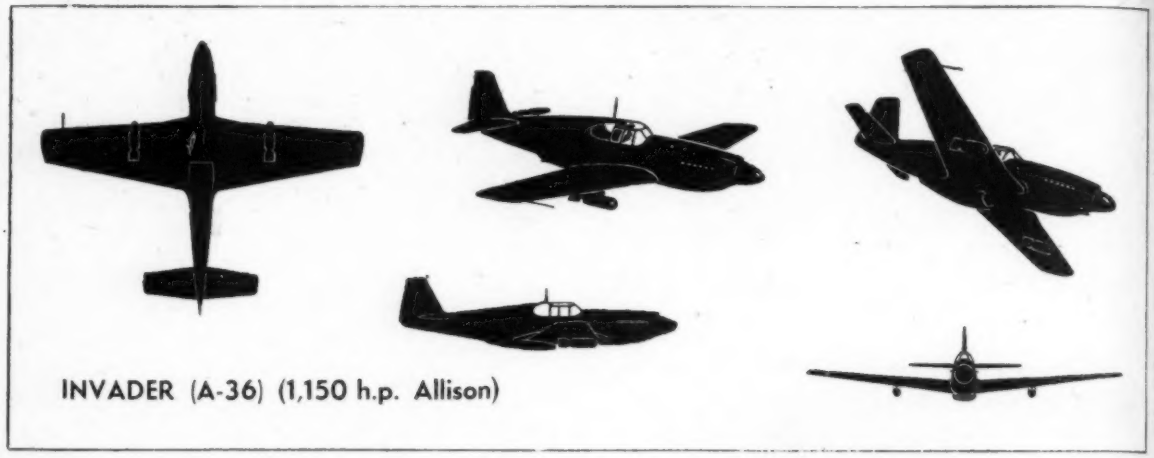
The existence of a terminal airport at Prestwick ceased to be a military secret when the Biennial Report of the Chief of Staff of the U.S. Army was published in America by the Government Printing Office last summer. The security "stop" on the name and location of the base, which British newspapers had obeyed scrupulously, was removed automatically by publication of the report in this country by H.M. Stationery Office on October 28.

The report contained a chart on which Prestwick was not only named, but the flying time from New York (twenty hours) was noted for comparison with the time taken on passage by ships in convoy from New York to Liverpool (seventeen days). In the light of these facts complaints about the content of recent B.B.C. broadcasts seem slightly irrelevant.

STILL ON TOP: One of the pointed-wing Spitfires which have now been in operation for some while. The extra wing area gives the Spit a much higher service ceiling, and, at the same time, detracts but little from the top speed. The object of the clipped wing Spitfires is to increase manœuvrability.

Studies in Recognition

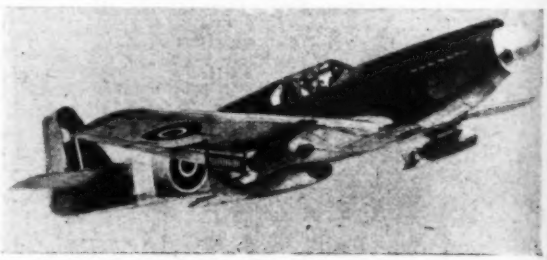
Aircraft in



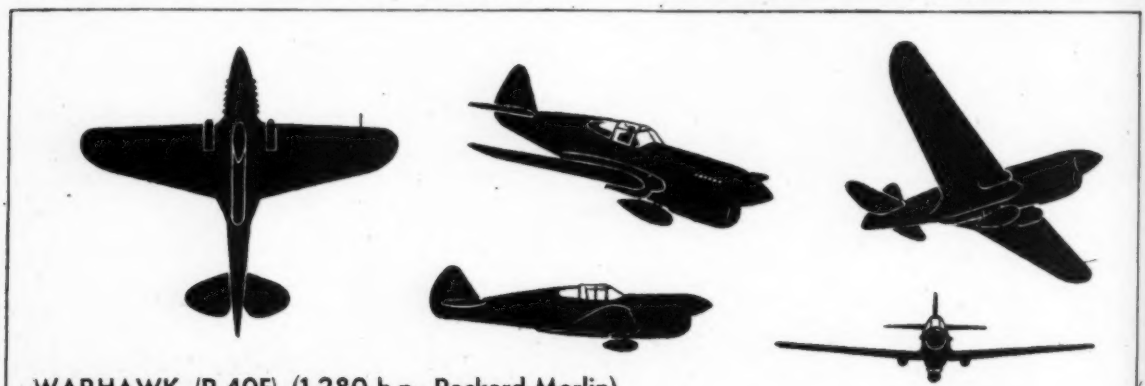
INVADER (A-36) (1,150 h.p. Allison)

A FIGHTER dive-bomber version of the North American Mustang single-seater fighter (P-51), the Invader, with U.S.A.A.F. designation A-36, proved its worth in the invasion of Sicily. Having done its dive-bombing, it can function as a low- and medium-altitude fighter. Powered by the 1,150 h.p. Allison engine, the Invader differs externally from the Mustang only in having bomb-racks beneath the wings and slotted-type dive brakes, outboard of these, opening above and below the wings. Two 500 lb. bombs are carried and armament consists of two 0.5in. machine guns firing from blast tubes under the nose, and four machine guns of either 0.5in. or 0.303in. in the wings. Top speed is 350 m.p.h.

Recognition features are basically those of the Mustang and include square-tipped tapered wings and tailplane, angular fin and rudder and radiator amidships. Dimensions: Span 37ft., length 32ft. 3in., height 8ft. 8in., wing area 235.75 sq. ft.



North-American Invader (A-36) Fighter-bomber.



WARHAWK (P-40F) (1,280 h.p. Packard-Merlin)

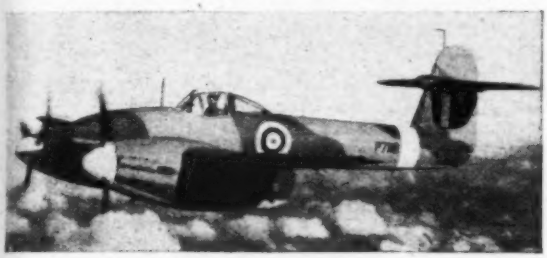
Curtiss Warhawk (P-40F) Single-seater Fighter.

THE first American fighter to be fitted with a Packard-built Rolls-Royce Merlin engine of 1,280 h.p., the Warhawk, P-40F, is also in service with the R.A.F. as the Kittyhawk II. Top speed is over 350 m.p.h. Armament comprises six 0.5in. machine guns in the wings, and a 500 lb. bomb or auxiliary fuel tank can be carried under the fuselage centre-section.

The Warhawk can be distinguished from earlier P-40 types by the absence of the air intake found on top of the cowling of Allison-engined versions. Other recognition features include heavy radiator beneath nose, straight leading edge and sharply forward-swept trailing edge, "wing-nut" tailplane, typically "Curtiss" fin and rudder, and backwardly retracting undercarriage with fairings beneath wings. Dimensions: Span 37ft. 4in., length 31ft. 9in., height 10ft. 9in., wing area 236 sq. ft.

ing Attitudes

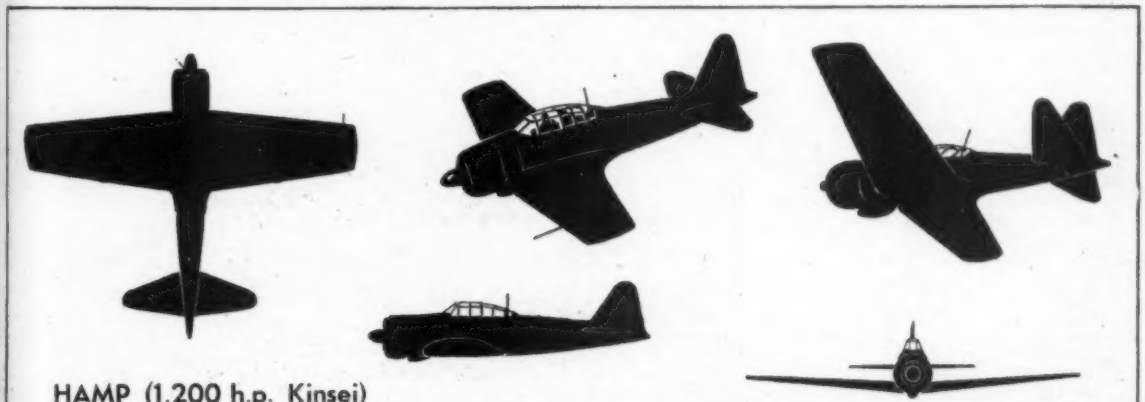
WHIRLWIND (Two 885 h.p. R.-R. Peregrines)



Westland Whirlwind Fighter-bomber.

ORIGINALLY designed as a day and night fighter, the Westland Whirlwind has been successfully adapted as a fighter-bomber for low-level attack against enemy ground installations and shipping, for which purpose it packs a formidable armament in the shape of four 20 mm. cannon grouped in the nose in addition to its bomb-load. Powered by a pair of 885 h.p. Rolls-Royce Peregrine engines, its top speed unhampered by bombs is 356 m.p.h.

The placing of the high aspect-ratio tailplane high on the tail fin forms a distinctive recognition feature. The comparative bulk of the underslung nacelles compared with the very slim fuselage, the extreme width of the flat rectangular centre-section of the low wing and the short tapered outer-panels set at a dihedral angle are other prominent characteristics. Dimensions: Span 45ft., length 31ft. 6in., height 11ft. 7in., wing area 250 sq. ft.



HAMP (1,200 h.p. Kinsei)

"HAMP" is the U.S. code name bestowed on the Mitsubishi Navy O. Mk. II single-seater fighter, which is a clipped-wing version of the "Zeke." It is powered by a 1,200 h.p. 14-cylinder two-row air-cooled radial Kinsei, which is an unashamed copy of the Pratt and Whitney. Improvements on the later Mitsubishi fighters include the provision of bullet-proof, or self-sealing, fuel tanks. Armament consists of two 20 mm. cannon in the wings, and two 7.7 mm. machine guns in the engine cowling; cannon and machine guns can be fired independently. Top speed is about 350 m.p.h.

Recognition features, beside the square wing tips, include uniform taper and dihedral from roots, large tapered tailplane and fin and rudder, short blunt nose and fuselage tapering sharply in plan. Dimensions: Span 36ft. 6in., length 29ft. 8in., height 9ft., wing area 228 sq. ft.

Mitsubishi Navy O. Mk. II (Hamp) Fighter.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

New Types of Aircraft

THE Berlin correspondent of *Magyar Szo*, Budapest, states that the *Luftwaffe* is using a new kind of aircraft in its attacks on Britain and London.

"The conviction is growing in the German capital," says the report, "that the Germans are launching their attacks on London from the stratosphere.

"Much is being said," continues the newspaper, "about the new German 'K' bombs, the effect of which far exceeds that of the heavy bombs or 'blockbusters' used so far, and the effect of the explosion destroys everything over a large area. These bombs weigh 500 kg. each, and the German pilots have given them the nickname 'Fat Emmas.'"

The new type of aircraft is said to have been developed by Capt. Mader, commander of a fighter squadron in the west, in collaboration with other *Luftwaffe* pilots who have had experience in raiding London.

Admission

GERMAN difficulties in rehabilitating important industries in the Ukraine since their occupation of Krivoi Rog over two years ago, were described by a German industrialist visiting Switzerland.

The Swiss *Weltwoche* gave the following interesting extract of his statement: "Our men responsible for bringing concerns into production again needed above all machines. They wrote, telegraphed and telephoned to the Ruhr district for machines. Since spring, 1943, they always received the answer that there was no possibility of delivery at the moment. It was the *air offensive over the Ruhr that held up deliveries.* Factories in the Ukranian ore district had to 'muddle through' and establishments could seldom work to full capacity."

Air Support

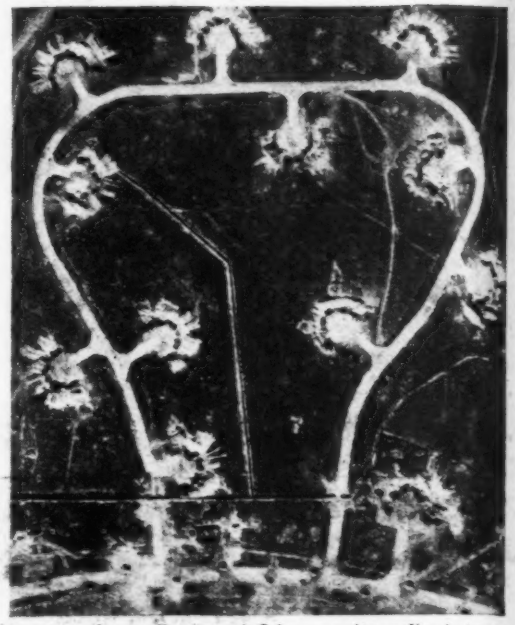
IN an address to Nazi Party leaders in Hamburg, *Luftwaffe* Gen. Quade pointed out that the *Luftwaffe* "prefers to operate indirectly" over the battlefields on the Russian front.

The General stressed the importance of the assistance rendered to encircled German troops by air transport units, stating that on one occasion alone they covered about 300,000 miles in 2,550 flights and brought some 20 million lb. of war material (or the equivalent of about 600 railway vans) to the front.

Submerging

"NOWADAYS in Germany nobody knows whether he is talking to Dr. Jekyll or Mr. Hyde," says a Swiss recently returned from Germany in an interview with *Die Nation*. "One can disappear and submerge in the sea of disorder and confusion. Disappearing has been developed into a regular science. There are many people whose lives are in danger, not only deserters and criminals, but in particular politically compromised men. For these people there is no better solution than to give up their existence as such, to allow themselves to be declared dead or missing and to come to the surface again in some other city as a different person.

"The process is as follows: Some member of the man's family goes to the police station one day and reports that on a certain evening the man concerned had said he was going to pay a visit to a friend at a certain address. He had not returned from this visit and his relatives were most anxious. The police investigate and find that this particular house was totally destroyed in the night in question and there is no hope of the man being still alive. His relatives even say that they believe they can recognise his body among the charred corpses. He is therefore officially declared missing or dead. He is not dead, however, but by helping in the rescue work he has easily been able to obtain the papers of some dead man. He moves to some other city and it is impossible to prove his identity false."



CRATERISING: This picture, published in a German journal and showing dispersal points on an airfield in Russia destroyed before the *Luftwaffe* exit, is meant to demonstrate the thoroughness of German scorched-earth policy.

Service to Customers

THE German Press gives interesting details about the new service of the Reich broadcasting system. The service has just set up a new transmitting station with a view of notifying the population from hour to hour about the movements of the Anglo-American aircraft. Thus, as soon as the enemy squadrons approach German territory, listeners are informed of the strength of these squadrons and as to how they are made up. The German population can therefore at any moment get an exact idea of the progress of the Anglo-American formations. Listeners are thus in a position to know if their town is directly threatened or not, or if there are no aircraft over German territory.

"It is thus possible," points out a German commentator, "again to return home after visiting friends without listening at every station or stop. One can again start a big job without being afraid that one will have to pack everything up again the next moment."

How this new warning system worked during last Monday's big daylight raid on Berlin was described by a German overseas radio reporter, quoted by *Reuter*. "I knew quite well what was going on in the air without seeing much, for we have a special radio service when there is an alarm," he said. "At short intervals, the *Luftwaffe* announced the exact position of the enemy formations, the course of the machines, the probable targets, the activity of the German *flak*, the German fighters, etc.

"About noon-time, after the alert had been sounded, it was announced that strong enemy bomber formations were approaching the capital at a relatively slow speed, and were observed about 50 to 60 miles west. A little later we were informed that the American aircraft were seen steering their course southward and after another 10 to 15 minutes they were reported over the outskirts of Berlin.

"'It is most likely,' the announcer said, 'that some of the enemy bombers will get through the defences and reach the city itself.' As a matter of fact, they did. I saw it."

Labour Shortage

AN item in the *Völkischer Beobachter* of March 6th, 1944, entitled "The repair of air-raid damage in Berlin factories," says that, in the first place, every factory tries to repair the damage caused by air attacks with its own workers so that production can be maintained on the old level. The president of the Berlin Gau Economic Chamber, Professor Dr. Hunke, discussing this subject in the *Wirtschaftsblatt der Gauwirtschaftskammern Berlin und Mark Brandenburg*, says that in future it will be more necessary than ever to carry out makeshift repairs with one's own workers or with community help which has proved so valuable in the past.

Hush-Hush

ACCORDING to neutral reports, the Germans suspect that the Allies have secret airfields in France, where British aircraft land with arms for the French patriots, and whence they carry certain persons off to security in Britain.

Growth of U.S. Air Power

Revealing Report of the Commanding General of American Army Air Forces : Surging Production of Aircraft

"AS from January 1st, 1944, it can be revealed that the Army Air Forces number 2,385,000 officers and men, as was planned two years ago. Yet only a few years ago the Commanding Officer knew literally every man in the Air Corps."

This statement, taken verbatim from the *Report of the Commanding General of the Army Air Forces to the Secretary of War*, published by the U.S. War Department Bureau of Public Relations, compresses into one sentence the story of the growth of American air power.

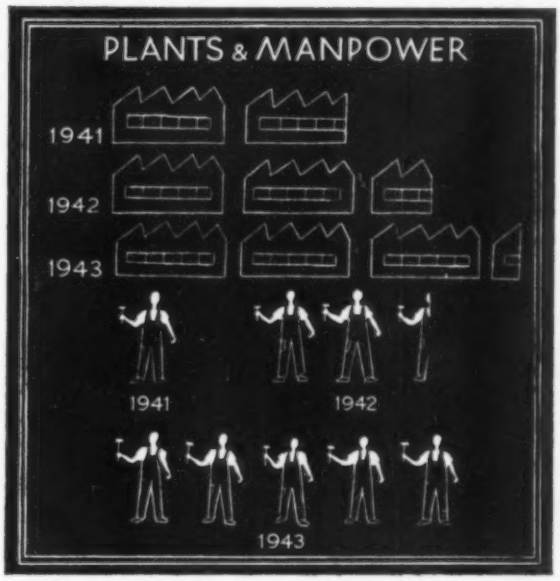
Distinguished by its admirable frankness, the report does not attempt to gloss over the initial difficulties, and, while striking a well-deserved note of optimism, it is factual and strictly to the point. With the help of this revealing document and information at different times released by the U.S.O.W.I. it is now possible to present a fairly rounded-off picture of American developments.

In 1938 the Army Air Force had about 1,300 officers and 18,000 men and about 1,600 aircraft. By contrast Hitler used over 3,000 in one campaign—the conquest of Poland. At that time the U.S. monthly production of aircraft amounted to some 100 machines.

On January 12th, 1939, the President asked Congress for a 300 million-dollar Air Corps appropriation to provide for an increase of personnel and a production of 5,500 aircraft per annum.

The consequent expansion of aircraft production and the gradual improvement of types—at that period the U.S. was still outside the war—have benefited from the experience gained by combatant nations. Ever since September, 1939, the Army Air Force has had observers in Europe at various times (among them General Spaatz and General Kenney), but in the absence of actual combat experience the danger existed that plants would be committed to production of types which would be obsolete by the time they would be needed.

An understanding was reached with the purchasers, providing as a condition of sale that purchasers should furnish the U.S. with their latest information on combat improvements. These improvements, covering a range of aspects from leak-proof fuel tanks to protective armour, greater fighting range, tail guns for bombers, etc., were adopted by the U.S., and proved valuable when America entered the war. Thus during the "short-of-war" stage, aircraft in production were being periodically modified without additional cost to the U.S.



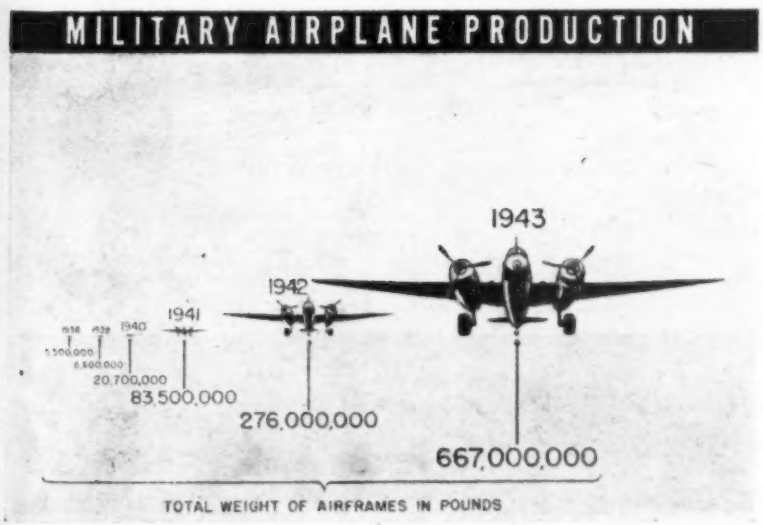
CRESCENDO: The growth of U.S. airframe production facilities. Each plant symbol = 40 plants. Each man = 200,000 workers.

Air Power and Numbers

Perhaps as important as the growing production facilities was the gradual cure of a rather typical American predilection for figures. "The Army Air Forces," says the Commanding Officer's Report, "had to teach the nation that large numbers of planes did not, in themselves, constitute air power." The "folly of the number racket," which the Air Force persistently tried to expose, was not entirely dead even after the war broke out, as many people thought that aircraft in large numbers—any kind of them—would win the war. In a democracy such public opinion was dangerous, and the educational task was not easy

The Army Air Force was again forced to adopt makeshift methods. Early in 1940 a programme was agreed upon which included a large number of light trainer types—probably too large a proportion to meet with the whole-hearted approval of the Air Force. The total number of aircraft on order was increased considerably, and the first batch of 200 bombers was secured for the Air Force. Considering that this was at a time when the war in Europe was in its second year, this number was not large, but their acquisition came just in time to make possible the combat and supply operations after Pearl Harbour.

During the fiscal year of 1940 the Army Air Force received only 886 air-



GROWTH OF U.S. AIR POWER

craft of all types. By May that year about 2,000 aircraft had been sent to France and Britain, or a figure equal to about 17 months' output, estimated at the 1939 rate of production.

The industrial might, engineering skill and resources of the U.S. were being more and more mobilised to form a vast supply basis for the expanding Air Force.

In actual figures the review of this gradual translation of the American industrial potential into a war effective looks most impressive. Excluding non-military production and parts and sub-assemblies, the number of U.S. assembly plants in operation, including American-financed Canadian plants, rose as follows:—

Year	Engines	Airscrews	Airframes
1938	4	2	9
1939	7	4	17
1940	12	4	25
1941	16	9	38
1942	22	13	51
1943	22	19	67

The labour force of these final assembly plants, excluding Canadian, increased as shown in the following table:—

Year	Engines	Airscrews	Airframes
1938	7,000	1,000	24,000
1939	8,000	1,500	28,000
1940	25,000	4,000	86,000
1941	59,000	10,000	199,000
1942	157,000	25,000	471,000
1943	271,000	48,000	864,000
Estimated December 1943	361,000	56,000	1,022,000

But the gearing-up to full-swing wartime production is, perhaps, best shown by the following comparative figures of output:—In September, 1939, it amounted to 117 aircraft; in January, 1942, to 2,972; in January, 1943, to 5,013; in September, 1943, to 7,598; in October to 8,362, and in November that year to 8,800 aircraft.

Pearl Harbour Acceleration

These results were obtained by mobilisation of the industrial resources begun before but greatly accelerated by Pearl Harbour. To produce them a deep incision into the current industrial methods was required which, in the words of an American commentator, was not without casualties. "The most important of these casualties," states the American Aircraft Year Book for 1944, "was the competition between aircraft manufacturers which died of quick strangulation within 90 days of the Japanese attack. Even before decent mourning had been observed, a marriage took place merging the aircraft industry with the mass production technique of the automobile industry. The issue—quantity production."

The multiple production lines which, to take a random example, increased the Seattle factory output about eight times; the sub-contracting which, according to estimates, is responsible for about one-third of all aircraft production; and the simplification of working processes by breaking them down to basic operations, were the source of strength of this surging production. Another important factor was the development of specialised tooling and the steady increase in labour productivity, the latter increasing by 37.5 per cent. alone in the last eight months of 1943.

Output figures should be considered in conjunction with an addition of several footnotes. First, despite the flexible and timely attention to the application of combat experience, it is impossible to plan a production of such dimensions and to have a flow of output without a percentage of types of a "secondary combat value." In face of actual experience in the battle skies, types scheduled to leave final assembly ten months ahead must often be subjected to substantial modifications to make them fit for combat. There is, therefore, a time-gap between what leaves the final assembly line and what enters the service.

Secondly, the quantitative increase in output does not by itself give the only true picture of the achievement, since the size of aircraft increased, and measured on a weight basis the production has increased during the second half of 1943 more rapidly than in 1942.

The chairman of the W.P.B. announced on January 25th that during the whole of 1943 the aircraft industry produced 85,919 aircraft of all types, as compared with a total output of 45,857 in 1942.

Concurrent with this 80 per cent. increase in production in terms of numbers, the proportion by weight, exclusive of spare parts, increased by 127 per cent. from 37,000,000 lb. monthly at the start of 1943 to 84,000,000 lb. in December last. In other words, the average weight of aircraft produced in December, 1943, was 9,500 lb. as against 5,570 lb. in 1942.

Qualitative Output

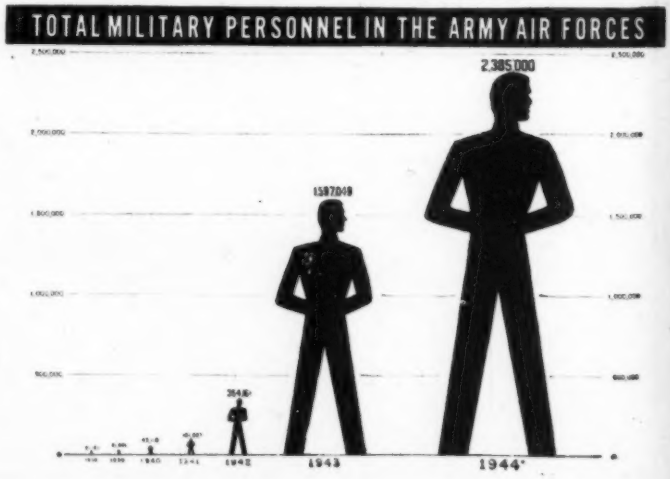
Finally, the qualitative aspect of the output is an essential component in an attempt to assess its practical value. In this respect the old maxim that one can learn best by one's own mistakes proved its validity. There can be little doubt that in the period of, say, the last two years the quality (as fighting weapons) of aircraft produced has improved considerably. To no small degree this improvement can be attributed to the intimate co-operation with the R.A.F. and the considerable measure of combat experience of the British Service.

The report of the Commanding General of the Army Air Force states that up to October 1st, 1943, a total of 26,900 aircraft had been exported on lease-lend or direct purchase basis, of which almost 7,400 were sent to Russia.

The relation of this figure to the U.S.A.A.F. own needs may be surmised from President Roosevelt's eleventh report to Congress on lend-lease operations (August 25th, 1943) covering the period ended July 31st, 1943. The President said that munitions exports under this agreement "in the past year were equivalent to 15 per cent. of our munitions production in that period. In the year ended June 30th, 1943, 17 out of every 100 bombers produced, and 25 out of every 100 fighters, were sent under lend-lease."

That the requirements of the U.S.A.A.F. itself have not as yet reached saturation point is evident from a statement in the Commanding General's Report saying that "none of our Air Forces has the planes it should have. Everyone could use double the number it possesses."

To provide this demand, more than one-half of the Army's entire production in 1944 will be aircraft and their



GROWTH OF U.S. AIR POWER

equipment, and 145,000 aircraft are scheduled by the W.P.B. in the next fifteen months. Over 75 per cent. of these will be combat types, and the trainer and certain other type production will be cut about 50 per cent.

The trend of the current year's aircraft production is thus clearly towards heavier machines, notably of the B.29 type, long-range transport aircraft, and other high-performance types. In terms of airframe weight, this shift to the heavies means that these aircraft will average 10,000 lb. as compared with 8,600 lb. per aircraft in 1943. The weight of heavy bombers alone to be produced in the next 18 months is scheduled to exceed that of all types of aircraft produced in the first year and a half of war.

Explaining that such steep rise in output numbers and weight will be possible with the planned 15 per cent. increases of the working force, and a further improvement in labour efficiency, Mr. Joseph D. Keenan, vice-chairman of the War Production Board, pointed out that since June, 1943, the production of Fortresses has increased over 40 per cent. The increase in personnel was only 15 per cent.

The ceiling of the American production effort is, even now, not in sight. But our Allies are living up to their war production chief's dictum that "the only way of being sure of having enough is to have more than enough."

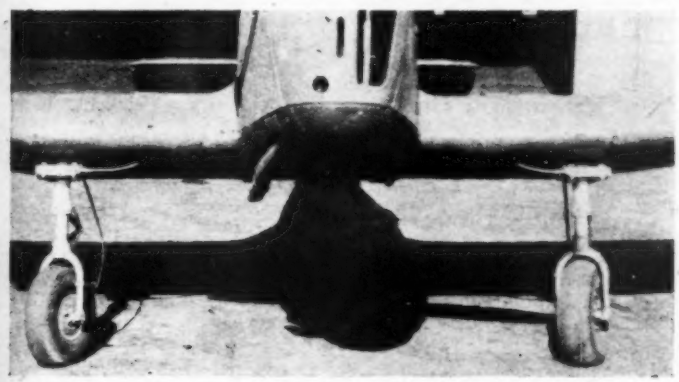
Making One Runway Do

Where the Maclaren Undercarriage Can Save Money : Need for Ruling by Civil Aviation Authorities

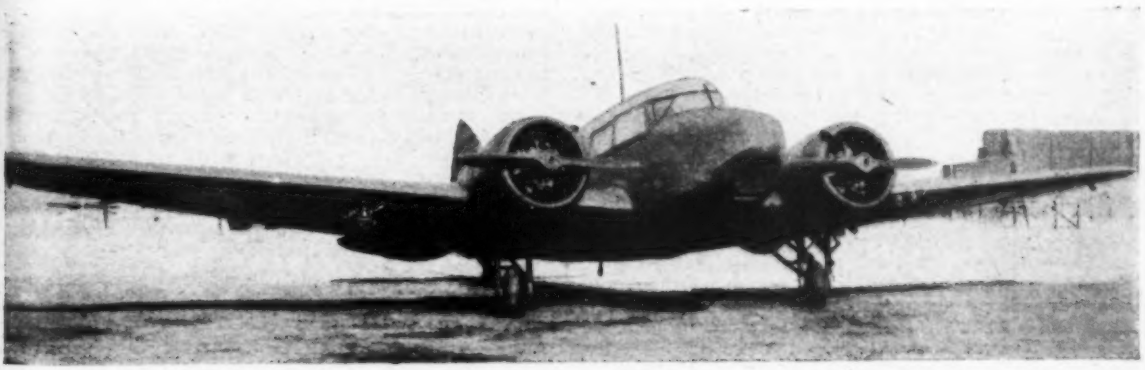
FIGURES have largely lost their meaning during the war. The amount of money which we spend weekly and even daily is so astronomic that the figures fail to convey any impression of actuality. It is very much to be feared that this habit will be carried over into the post-war years. Already we hear of plans for airports with runways (several of them) of a couple of miles or more in length. The whole thing is becoming fantastic and makes one wonder whether anyone has ever taken the trouble to work out the cost of establishing an airport of this sort, running it and doing the necessary maintenance work. The interest on capital alone will be a big item.

The tendency is obviously to expect the Government—that is to say the nation, otherwise the taxpayer—to provide these marvellous facilities. Unless the burden on rates and taxes is to become insufferable, there will have to be *some* payment in return. Not, to be sure, the whole amount, for no such airport has the slightest chance of becoming self-supporting for many years to come, but enough to reduce the subsidy (for such it will have to be, whatever form the Government support takes) to reasonable proportions. The revenue will have to come partly from firms which establish factories or offices at the airport, and partly from landing fees. Unless the density of traffic is far greater than can well be foreseen and expected at the present time, the landing fees (or their equivalent in the form of a monthly or annual contribution) will have to be very high indeed. The aircraft operator will perforce be compelled to pass them on to the travelling public in the form of higher fares, the which will tend to reduce the number travelling, and hence the revenue.

The chief, although not, of course, the only, cause of the great cost is the length of runways required by modern highly loaded aircraft. The fact that the wind may be blowing from any point of the compass, and that aircraft as at present constituted cannot land very many degrees "out-of-wind," in spite of tricycle undercarriages, means that several runways have to be provided, one running in the direction of the prevailing winds and the others



As applied to the Miles Magister, the Maclaren drift undercarriage was mechanically operated.



The drift undercarriage fitted on an Airspeed Oxford was hydraulically operated. In the picture the wheels are set over at an angle of 25 degrees.

MAKING ONE RUNWAY DO

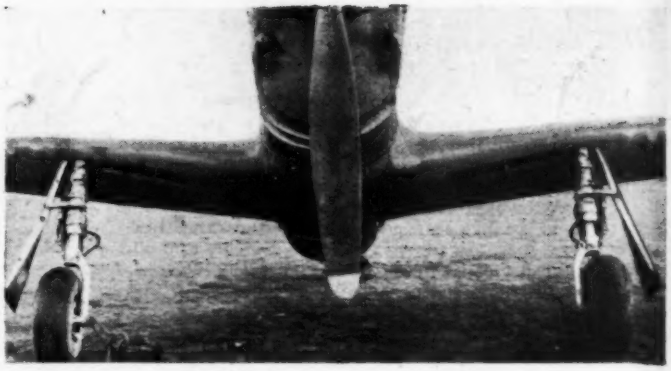
at angles to it. Thus, even taking a fairly modest dimension, such as 2,000 yards, an airport must, to give at least this length of runway, be a square measuring 2,000 yards a side. This gives an area of four million square yards or, in more familiar figures, 825 acres. The value of this, if near a town, will be considerable.

To allow for swings and other deviations in unfavourable weather conditions, it is generally agreed that runways should be some 300 yards wide. That would represent something like the equivalent of 7 miles of runways in an airport of 2,000 yards a side. This is not quite a fair figure to take because the whole airport area would not be runways. But even if we take, within our hypothetical airport of 2,000 yards side, only four runways, the total is still impressive. If we think of our airport as lying with two of its sides facing north-south and two facing east-west, the south-west-north-east and south-east-north-west diagonals would measure 2,830 yards each. The north-south and east-west runs would be 2,000 yards. These four runways would total a distance of about 5½ miles.

If aircraft characteristics were such that the four runways could be placed end to end, we should thus have a runway 5½ miles long! Even the largest and most heavily loaded aircraft envisaged should not require more than that. This distance compares with the 2,830-yard diagonal of the square airport. The advantages are too obvious to need stressing.

From the technical point of view it has been proved pretty thoroughly that it *is* possible so to equip aircraft that they can land safely and take off safely with the wind at right-angles to the runway. The idea is far from new, but it deserves the most careful study by our Directorate of Civil Aviation, aircraft operators and municipal authorities

The scheme was first proposed in 1938, when Mr. O. F. Maclaren devised what he called his drift undercarriage. It was tried with a fair measure of success on the little Arpin pusher monoplane. The idea was so to arrange the undercarriage (in the Arpin this was a tricycle) that the wheels could be set at the angle of drift so that although the aircraft was "crabbing" the wheels were parallel with the flight path.



The Maclaren drift undercarriage on a Mustang. The wheel-setting mechanism is behind the shock-absorber leg.

The outbreak of war put a stop, for a time, to further progress, but later Airwork, Ltd., of Heston, Middlesex, took up the idea and developed it. Several types of aircraft, single-engined and twin-engined, were fitted with the Maclaren pre-set undercarriage, and in all cases it was found that, from a technical point of view, it did all that was claimed for it.

It now remains for interested people to decide whether the additional one per cent. of the loaded weight which this undercarriage represents compared with the orthodox type is not well worth while. The system is applicable to tricycles but equally to the tailwheel type. The additional weight of a tricycle is approximately 3 per cent. of the loaded weight.

Boundary Layer Control

READERS who perused the article which appeared under the above title in last week's issue of *Flight* will undoubtedly have noticed the discrepancy which existed between the illustration in Fig. 5, page 261, and the text which purported to relate to it.

We regret to state that the illustration which appeared was inserted in error, and to rectify the matter we publish herewith the correct illustration of the Bristol exhaust-actuated boundary layer control proposal, together with a reprint of the relative text.

A project sponsored by the Bristol Aeroplane Co., Ltd., A. H. R. Fedden and F. M. Owner, in 1936, is shown diagrammatically in Fig. 5. This is of interest as it employs the energy of the exhaust gases from a normal engine, which would otherwise be lost, to suck in the air from the boundary layer over part of the upper surface of an aerofoil. No demand is made on the power output of the engine and no auxiliary source of power is required.

A radial engine driving an airscrew is mounted forward of the leading edge of the wing of what is apparently a very large aircraft. The exhaust gases are collected in a ring A, located at the leading edge of the engine cowling, and delivered by a tail pipe B to a mixing chamber C. The upper surface of the wing, along a band D lying at about the middle of the chord and running lengthwise of the wing, is formed with a series of perforations. These are preferably small, closely pitched holes, say, one sixty-fourth of an inch diameter and spaced one-quarter of an inch apart.

An inlet conduit E leads from the perforated strip to the chamber C, from which a conduit F leads to an outlet orifice in the lower surface of the wing near the trailing edge. From the tail pipe the exhaust gases discharge through a Mélot-type multiple ejector-nozzle, or "thrust-augmentor" G.

Together, nozzle G and chamber C constitute a fluid ejector which draws air through the perforated strip D, along the conduit E to the chamber and expels it rearwardly, together with the exhaust gases, through conduit F. The path from the perforations to the outlet is designed to give a smooth flow and diverges gradually to the chamber and then converges to the outlet. In this manner the kinetic energy of the air in the conduit E is converted to pressure energy. In chamber C the air is entrained by the exhaust gases and in flowing to the outlet the pressure energy is reconverted to kinetic energy and a forward thrust is obtained to assist the propulsion of the aircraft.

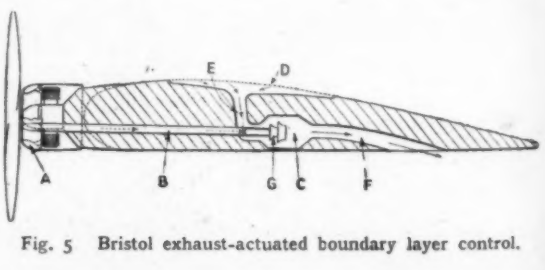


Fig. 5 Bristol exhaust-actuated boundary layer control.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

JET PROPULSION OF AIRCRAFT

A Fourth "Dimension"

YOUR editorial note (*Flight*, February 24th) to Stuart Watts' letter is, I suggest, incorrect. "Action and reaction must be opposite and equal" is the oldest of the Newtonian laws. Therefore, the jet must act on *both* aircraft and atmosphere.

Stuart Watts' explanation of a punctured balloon is not correct; the reason that it would travel in the opposite direction even in a vacuum is that individual molecules would gradually slow up and thus form an abutment to the succeeding ones. This would continue until the balance was reached and thus thrust it forward. S. H.-A.

[We suggest to this correspondent that if this view were correct, a rocket would not work in a vacuum.—ED.]

Gunpowder as a Fuel?

THERE is a lot of "joy" in gunpowder, so one notes from your very helpful articles on jet and rocket propulsion. And your obedient servant has had one of his rare bright flashes.

Clearly, gunpowder is useful fuel for direct reaction propulsion, since, by its literally colossal expansion upon combustion, it makes available large amounts of energy in brief units of time—in short, it can do a lot of work.

Now the following assumption is the basis of the brilliant flash—namely, that the expansion of a pound of gunpowder is considerably greater than the expansion of a pound of spirit fuel (duly mixed with air). If this assumption be wrong—and a poor memory aided by no reference book may well make it so—then may this letter be consigned forthwith to the "misconceptions" file. But if it be true, why not gunpowder for "joy" in orthodox aircraft (or, for that matter, midget submarines or any other engine-propelled contraption)?

Thus, a series of charges (small or large, to suit all tastes) fired into a "pressure tank," whence the gases can be allowed to gush forth at any convenient rate through any convenient type of pipeline to drive any convenient type of engine, turbine or reciprocating.

The gunpowder charges could be belt-fed, like bullets, and fired every time the pressure in the "tank" falls below a desired figure by a simple pressure-valve trip-lever. For the rest, it works as though the medium were steam.

The advantages seem numerous:—

(1) Providing the aforesaid basic assumption is true, very great saving in fuel weight.

(2) Entire independence of atmosphere—i.e., no supercharger to lug around the sky (weight) or to drive (power).

(3) Providing the previous flight did not terminate through exhaustion of the pressure in the tank, "starting up" is instantaneous: you just turn on the tap.

(4) The "mixture" is entirely non-flam (as Wardour Street would have it), and there is no reason why the "ammunition," firing mechanism and pressure tank should not be 'way back in the part of an aircraft which usually survives a crash—at any rate, away from the hot engine oil—that prime aid of Satan.

Since orthodox forms of propulsion in the air are bound to endure a couple of decades more at least, the idea seems better every time it is reviewed: so much so that the odour of a rat is apparent in the fact that it is not already in general use. Though one can think of none, it seems there is a snag somewhere. Is there? "DRIVER."

FINNED TUBES

Many Advantageous Uses

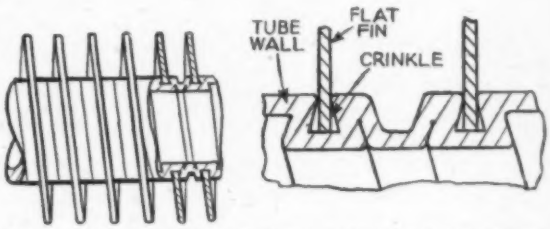
I NOTICED with interest your suggestion in *Flight*, February 17th, of a gas turbine power plant, and with reference to previous correspondence I add my observations.

I believe it to be to our advantage to make use of *ribbed* cooling surfaces in the construction of air ducts and other heat exchanger problems. The exchangers can be so designed, in tubular form, that the medium to be treated is guided over the external fins, and the acting agent through the bore of the tube. The process can, of course, be reversed.

The drawing shows the type of tubes indicated.

Again, for de-icing, finned tubes are admirably suited, when applied in the same manner as suggested years ago.

With regard to your item headed "Ju 88 Gadgetry," in



"Here and There" of the same issue, the answer to the query is that the type of fastening used is the most simple and positive, both from the angle of application and production.

I designed exactly the same thing in 1938, the patent was applied for, and I suggest more use of this type of fastening.

J. F. HENDRIK RENARD.

THE WORLD'S BEST AIRCRAFT

A Pardonable Error

MAY I use a little of your space to criticise Mr. Masefield's choice of the world's best aircraft?

First, it must be remembered that while we Britishers hold back information on new types, the Americans tell the world about them before even the prototype has flown. To take one example. In the category of high-altitude fighter he has compared the Mustang II with the Spitfire IX unfairly because the Spitfire IX is of the same period as the Warhawk and the Mustang I, to which it was superior. The Mustang II should be compared with the new British fighters, the names of which cannot be given for security reasons, which are definitely better than the Spitfire IX and Typhoon, and consequently the Mustang II.

Similarly, in the low-altitude category I am convinced that the clipped-wing Spitfire IX would out-manœuvre the Mustang I; in fact I have seen it doing so.

Then I feel sure that the Typhoon IB would make a better show as a fighter-bomber than the Lightning. Both carry 1,000 lb. of bombs, and the Typhoon is superior in fire power, speed and manœuvrability.

Fourthly, he does not even mention the York in the long-range transport class. Although it is probably no better than those mentioned, I think that it is at least equal to them. Anyway, I consider the Constellation superior to the Skymaster.

Why Mr. Masefield does not consider the night-interceptor worthy of inclusion is indeed a puzzle to me. Also, if that class were included, I certainly consider the Mosquito II superior to the Beaufighter. The latter is a fine aircraft, but is not fast enough for present-day requirements. The Messerschmitt 210 and 410 could easily outpace it, and the Junkers 188 and the Dornier 217 would give it a good chase.

Taken all round, though, Mr. Masefield's article is a good one, and as everybody feels a certain amount of patriotism we cannot blame him for including more American types than British. R. E. GREGORY.

[Our correspondent makes a pardonable mistake in supposing Mr. Masefield to be a patriotic American; he is British —ED.]

TYPHOONS v. JUNGMANNS

Fighter Pilots Not Criticised

WE are sorry to see that apparently "Junior" (*Flight*, March 2nd) had a spasm of short-sightedness when reading Ian S. Alexander's letter on the subject of "Typhoons and Jungmanns" (*Flight*, January 20th). How also could he have missed seeing the words "sordid necessity" at the head of the said letter? How else could he have overlooked the entire second paragraph in which the writer plainly stated that unfair as it may seem, training machines should not be spared? Mr. Alexander's letter conveyed to us no criticism of the Typhoon pilots, but merely of the newspapers', and B.B.C.'s, treatment of the incident.

With regard to "Chief Test Pilot's" letter (*Flight*, February 3rd) on the same subject, we bow to his superior knowledge, but we would make two observations. First, is

CORRESPONDENCE

the Jungmann, an aircraft designed as a trainer, as manœuvrable as the Auster, designed with ultra-manœuvrability in view? Secondly, the German pilots were not A.O.P. officers, to whom the dodging of fighters is considered as part of the day's work, but inexperienced trainees.

"TWO BRIGHT SPARKS."

Lysanders were Also Manœuvrable!

I TRUST you will forgive this further intrusion into your space, prompted as it is by "Junior" (R.C.A.F. Pilot)'s reply in *Flight*, March 2nd, to my letter of January 20th.

At the risk of being wearisome I should like to mention that I then expressed my opinion on two matters as follows:—

(*a*) That a slow manœuvrable aircraft is practically defenceless against a fast fighter;

(*b*) That the more sordid aspects of warfare, necessary in a total war, should not be publicised as something to be applauded, or as amusing incidents.

The reply of "Chief Test Pilot," dealing with point (*a*) is so full of controversial matter that I hesitate to become further involved by replying to all his points. However, although I have never flown a Typhoon, and as one whose business it is to know how an aircraft will fly from a designer's rather than a pilot's point of view, I should like to make the following few points. That Me 109Es (Daimler-Benz motors) with a speed of approximately 350 m.p.h. *did* fight in the Spanish War; that all engagements are not necessarily tail-chasing matches (an assumption which Chief Test Pilot seems to have made the basis of his argument), that Typhoons can and do fly low very successfully to attack railways locomotives (admittedly easier targets than a manœuvrable Jungmann); and that the Auster which escaped from nine Messerschmitts did so by flying up and down a defile.

So far, nothing which has been put forward against my contention has done more than prove that a Jungmann can turn inside the turning circle of a Typhoon. The plain fact remains, however, that an encounter between two such aircraft takes on much of the aspect of a fighter *v.* bomber engagement. The Typhoon could break off the action and renew it at will at periods determined by the time necessary for it to flick up on to its back and come down in a dive on its target. The Jungmann would obviously not be sitting awaiting its return or even moving at a slow speed in a straight line, as would a train but it would be very limited in its movements compared with an aircraft that could acquire altitude four times as fast. Frankly, I disbelieve the story that the aircraft concerned flew in tail-chasing circles. The obvious method of attack would be in the vertical plane, in which case the difference in manœuvrability would not be so marked.

Incidentally, as one who knows something about the manœuvrability of Lysanders, from practical experience, I cannot help remembering how they were practically massacred in France.

With regard to "Junior" and point (*b*), might I suggest a more careful perusal of my original letter?

IAN S. ALEXANDER (Stud. R.Ae.S.).

THE FLYING BOAT

Values Not Sufficiently Stressed

REFERRING to the article "The Flying Boat" published in your issue of February 24th, together with your editorial comment, might I point out the principal values of the flying boat, which do not seem to have been stressed sufficiently to make it quite clear that the flying boat stands in a category of its own?

In the first place, many countries and islands are so mountainous in formation that airfields are not available anywhere, in which case the flying boat is the only form of aircraft that can be used. Secondly, the flying boat, when flying over water, always has an "airfield" beneath it for forced landings. Thirdly, no undercarriage has yet been designed to carry a load above about 60 tons, so that all developments above that tonnage must of necessity be flying boats—or shall we say "flying ships"?—to make a distinctive classification. The Editor might settle this classification once and for all, to the mutual advantage of all. The "flying ship" classification should be above the tonnage that it is possible to land on an airfield.

I have personally designed a flying ship of 300 tons which is more efficient by 25 per cent. than any other form of aircraft. This tonnage could only be landed on water. I should also like to point out that a flying ship could always run alongside a quay for loading, like any other ship.

J. R. CROULD (Major, late R.A.F.).

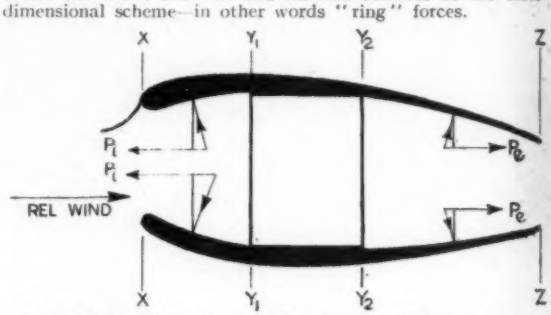
THE DUCTED RADIATOR

Thrust from Increased Air Velocity

YOUR correspondent Mr. R. D. Morrell (*Flight*, January 27th) requests an explanation of "Dragless Cooling," and it is possible that the following straightforward survey may meet his requirement, although avoiding any exact discussion of duct design.

The purpose of a duct is to collect the cooling air, slow it down, cause it to pass through the matrix and take up heat, at the same time losing pressure, and finally accelerate it to join the main air stream in a manner which will avoid breaking up its streamline flow.

This process obviously produces a rearward force (drag) on the radiator matrix, but this is largely counterbalanced by the air forces developed on the duct itself, which is of aerofoil section. These forces give a resultant in the direction of motion of the aircraft, as can be seen from the diagram, which is a two-dimensional representation of a duct, and it is to be observed that the force systems shown should be summed round the whole external and internal surfaces of the three-dimensional scheme—in other words "ring" forces.



From XX to Y_1Y_1 the air slows down, building up a pressure in accordance with Bernoulli's theorem. This pressure, acting freely in all directions, can be represented by a resultant "ring" pressure P_i normal to the walls of the containing duct. When resolved perpendicular to and along the direction of motion a component is apparent, acting as a forward thrust on the aircraft.

The same conception can be applied from Y_2Y_2 to ZZ but here the adverse pressures involved are of a lower magnitude. The rearward ring pressure P_e is therefore smaller than P_i and we are left with a net force in the direction of motion of the aircraft. Furthermore, there are air forces on the outer surface of the aerofoil duct contributing an additional "ring" resultant component to these other forces.

The practical existence of the forward force can be shown by a freely suspended Townend ring or, in this case, a light mock-up of a duct, on the face of which impinges the blast of a fan. The ring will move forward towards the fan.

Fortunately we need not evaluate all these forces in assessing the drag of a ducted radiator since they are all taken into account in the statement that the net drag is the rate of change of momentum of the air which passes through the duct, as can be shown by a detailed mathematical analysis.

Herein lies the explanation of the fact that the net drag may in fact be negative (i.e., a thrust). For the heat energy given to the air by the radiator may be greater than the losses it suffers in passing through the radiator and duct, so that it finishes up at a higher velocity than that at which it started, thus giving a thrust, *à la* jet propulsion.

The higher the internal velocity the smaller is the fraction of the original energy which is represented by the losses, and it can be shown that at aircraft speeds of the order of 450 m.p.h. the net result should be a thrust.

It should be noted, however, that our arguments have not taken into account the form drag of the duct walls, and it is debatable whether the above ideal has in reality been reached. There is no doubt, however, that the development work carried out by Rolls-Royce, Ltd., in their Installation Department at Hucknall, contributed largely to the narrow margin of superiority possessed by our fighters at the beginning of the war. The position could have been reversed if Germany had our knowledge of such things as duct cooling, carburettor intake ram and ejector thrust from exhausts.

C. L. HININGS, B.Sc., A.F.R.Ae.S.,
Superintendent, Aero Engine Instruction,
Rolls-Royce, Ltd.

AIR CHIEFS: (Left to right) Air Marshal Sir Roderic M. Hill, A.O.C. Air Defence of Great Britain; Maj. Gen. W. O. Butler, Deputy C. in C. A.E.A.F.; Air Chief Marshal Sir Trafford Leigh Mallory, C. in C. Allied Expeditionary Air Forces; Air Vice-Marshal H. Wigglesworth; Brig. Gen. Aubrey C. Strickland; (seated in foreground) Maj. Gen. L. H. Brereton, Commanding General 9th U.S.A.A.F. and, extreme right, Air Marshal Sir Arthur Coningham, A.O.C. 2nd Tactical Air Force.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Appointments

AIR VICE-MARSHAL JOHN HENRY D'ALBIAC has been appointed Deputy Commander, Mediterranean Allied Tactical Air Force.

He has been Air Officer commanding the home-based 2nd Tactical Air Force of the R.A.F. since its formation last year. Previously, he commanded an R.A.F. group responsible for light and medium bomber operations, including Mosquito attacks, from this country.

Air Vice-Marshal Sturley Philip Simpson, C.B.E., M.C., is to be Air Officer Commanding a group in Coastal Command.

Air Vice-Marshal William Elliot, C.B., C.B.E., D.F.C., is to be Air Officer Commanding R.A.F. Station, Gibraltar.

Air Vice-Marshal Simpson has been Air Officer Commanding R.A.F. Station, Gibraltar, since December, 1941. He was for three years previously in command of a home station.

Air Vice-Marshal Simpson was awarded the Military Cross in 1926 for his services in Kurdistan.

Air Vice-Marshal Elliot, who has been Director of Plans since April, 1942, served for the preceding eight months in the Operations Room at H.Q. Fighter Command.

He was an officer in the Army Service Corps during the last war, being seconded to the Royal Flying Corps in January, 1918, for flying duties.

Air Vice-Marshal Elliot was awarded the D.F.C. in February, 1919, a Bar to the D.F.C. in April, 1920, and holds the Russian Orders of St. Vladimar and St. George.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Service Order

Act. Group Capt. P. L. DONKIN, R.A.F.—Group Capt. Donkin has taken part in many operational sorties during which he has attacked transport targets with good results. Recently, from a low level, he obtained some excellent photographs of a heavily defended section of the French coast. As a commanding officer, Group Capt. Donkin has displayed outstanding leadership and by his careful planning and discipline has enabled his squadrons to undertake sustained offensive and photographic operations with notable success.

Act. Sqn. Ldr. C. E. S. PATTERSON D.F.C., R.A.F.V.R., No. 487 (R.N.Z.A.F.) Sqn.—This officer has an outstanding operational record. He has completed numerous sorties, mostly in daylight, against heavily defended targets. An excellent flight commander and pilot, this officer has consistently displayed outstanding devotion to duty and determination. Although his aircraft has often been damaged by anti-aircraft fire Sqn. Ldr. Patterson has always completed his allotted tasks.

Sqn. Ldr. J. G. DAY, R.A.F.O., No. 49 Sqn.—This officer has completed a very large number of sorties and has set a fine example of gallantry and devotion to duty. He has attacked targets in Berlin, Munich, the Ruhr and in many other centres equally important with much success; during a phase of the fighting in North Africa, Sqn. Ldr. Day also completed many sorties in that theatre. He is a fine leader whose efficiency has been reflected in the high fighting qualities of the flight he commands.

Act. Wing Cdr. L. A. LYNN, D.F.C., R.A.F.O., No. 320 Sqn.—This officer has completed a very large number of sorties and has displayed skill, courage and determination of the highest order. He is a most inspiring and forceful leader, whose personal example has been reflected in the fine fighting qualities of his squadron, which has obtained many successes in recent operations over Northern France.

Flt. Lt. G. Y. MACKIE, R.A.F.V.R., No. 115 Sqn.—As air bomber and captain of aircraft, Flt. Lt. Mackie has participated in a very large number of sorties. In the Middle East theatre he successfully attacked numerous targets in the Western Desert, Greece, Crete and in the Dodecanese Islands. Since then, Flt. Lt. Mackie has undertaken many sorties against important and well defended targets in Germany, including six attacks on the German capital.

Wing Cdr. John Cunningham, D.S.O., D.F.C., the well-known night-fighter pilot who was recently awarded a second Bar to his D.S.O. Wing Cdr. Cunningham was an A.A.F. pilot before the war.

SERVICE AVIATION

F/O. S. S. SHULEMSON, R.C.A.F., No. 404 (R.C.A.F.) Sqn.—This officer has completed numerous sorties, including several successful attacks on shipping. He is a skilful, courageous and determined leader, whose example has inspired all. In January, 1944, he participated in an attack on a convoy consisting of enemy merchant vessels and four armed ships. In the face of considerable anti-aircraft fire, the attack was well pressed home and a medium-sized merchant vessel and two smaller merchantment were hit and set on fire; hits were also obtained on two of the escort ships, one of them appearing to blow up. As course was set for home, one member of the formation was attacked by a fighter and sustained damage. F/O. Shulemson immediately turned and joined the fight. By skilful and daring tactics he drew away the attacker, thus enabling his comrade to fly clear. Some 18 minutes later, the enemy aircraft was forced to terminate the engagement and F/O. Shulemson flew on to base and landed safely in spite of a burst tyre on one of the landing wheels. Throughout the sortie, this officer displayed inspiring leadership, great skill and courage.

Distinguished Flying Cross

Act. Wing Cdr. L. COHEN, D.S.O., M.C., R.A.F.V.R.
Flt. Lt. R. D. WHYARD, A.F.C., R.A.F.V.R., No. 178 Sqn.
F/O M. FROST, R.A.F.V.R., No. 178 Sqn.
Flt. Lt. D. W. BARBOUR, R.A.A.F., No. 680 Sqn.
Flt. Lt. L. A. MALINS, R.A.F.V.R., No. 260 Sqn.
Flt. Lt. O. P. OLSON, R.N.Z.A.F., No. 260 Sqn.
Capt. C. F. HUTTENBACH, No. 651 Sqn.
Lt. A. SACHS, S.A.A.F., No. 92 Sqn.
W/O. H. H. LLOYD, R.A.F.V.R., No. 454 (R.A.A.F.) Sqn.
F/O. J. P. ROBERTS, R.A.A.F., No. 10 Sqn.
P/O. J. CHURCHILL, R.A.F.V.R.
P/O. A. J. FLOYD, R.A.F.V.R.
Act. Flt. Lt. H. D. CHURCHILL, R.A.F.V.R., No. 103 Sqn.
Act. Flt. Lt. C. PAYNE, R.A.F.V.R., No. 514 Sqn.
F/O. R. F. GRIFFIN, R.A.F., No. 103 Sqn.
F/O. E. MERCER, R.A.F.V.R., No. 44 Sqn.
P/O. D. C. HARVEY, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
P/O. J. A. McINTOSH, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
P/O. V. D. PURVIS, R.A.F.V.R., No. 44 Sqn.
P/O. T. B. SPINK, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
F/O. A. WRIGHT, R.A.F.V.R., No. 44 Sqn.
W/O. N. H. FROST, R.A.F.V.R., No. 103 Sqn.
Act. Flt. Lt. R. BOWEN, R.A.F.V.R., No. 78 Sqn.
Act. Flt. Lt. B. J. RUDGE, R.A.F.V.R., No. 78 Sqn.
Act. Flt. Lt. H. F. SLADE, R.A.A.F., No. 156 Sqn.
Act. Flt. Lt. M. C. STIMPSON, R.A.F.V.R., No. 156 Sqn.
F/O. R. E. SHINE, R.A.F.V.R., No. 161 Sqn.
Act. Sqn. Ldr. J. OVERTON, R.A.F.V.R., No. 218 Sqn.
Act. Sqn. Ldr. W. W. STRACHAN, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
Flt. Lt. BROWN, R.A.F.V.R., No. 136 Sqn.
F/O. E. ALLEN, R.C.A.F., No. 224 Sqn.
F/O. P. CALDWELL, R.A.F.V.R., No. 224 Sqn.
F/O. W. F. McG. DAVIDSON, No. 179 Sqn.
F/O. B. W. HEARD, R.A.F.V.R., No. 172 Sqn.
P/O. W. N. ARMSTRONG, R.C.A.F., No. 172 Sqn.
W/O. J. A. R. COULOMBE, R.C.A.F., No. 426 (R.C.A.F.) Sqn.
W/O. P. R. M. NEAL, R.A.F.V.R., No. 100 Sqn.
Flt. Lt. J. V. MARSHALL, R.A.F.V.R., No. 155 Sqn.
Flt. Lt. I. A. SUTHERLAND, R.N.Z.A.F., No. 82 Sqn.
Flt. Lt. G. W. MACDONALD, R.C.A.F., No. 82 Sqn.
P/O. G. E. LOCKEY, R.A.F.V.R., No. 9 Sqn.
P/O. A. MAITLAND, R.A.F.V.R., No. 76 Sqn.
Wing Cdr. F. R. C. FOWLE, R.A.F., No. 102 Sqn.

Distinguished Flying Medal

Sgt. W. J. BAYLEY, Army Air Corps.
Sgt. A. C. EVERETT, R.A.F.V.R., No. 76 Sqn.
Sgt. H. LIEVESLEY, R.A.F.V.R., No. 100 Sqn.
Sgt. W. R. W. MOLLER, R.A.A.F., No. 12 Sqn.
Sgt. J. ROBERTS, R.A.F., No. 161 Sqn.
Sgt. P. SUNDERLAND, R.A.F.V.R., No. 156 Sqn.
Sgt. C. J. WEARMOUTH, R.A.F.V.R., No. 101 Sqn.
Flt. Sgt. G. CUMMINGS, R.A.F.V.R., No. 192 Sqn.
Flt. Sgt. J. CUSHION, R.A.F.V.R., No. 44 Sqn.
Flt. Sgt. W. S. COPP, R.A.F.V.R., No. 83 Sqn.
Flt. Sgt. B. DENOON, R.A.F.V.R., No. 83 Sqn.
Flt. Sgt. J. R. DICKINSON, R.A.F., No. 7 Sqn.
Flt. Sgt. J. DORRIAN, R.A.F.V.R., No. 49 Sqn.
Flt. Sgt. R. DUDLEY, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. W. S. M. EDMONDSTON, R.A.F.V.R., No. 35 Sqn.
Flt. Sgt. (now P/O.) G. A. EDY, R.A.F.V.R., No. 49 Sqn.
Flt. Sgt. S. F. FINCHAM, R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.
Flt. Sgt. M. E. FOREMAN, R.A.F.V.R., No. 12 Sqn.
Flt. Sgt. A. V. HARDY, R.C.A.F., No. 35 Sqn.
Flt. Sgt. T. S. HAYWARD, R.A.F.V.R., No. 7 Sqn.
Flt. Sgt. G. JONES, R.A.F.V.R., No. 51 Sqn.
Flt. Sgt. P. L. T. LEWIS, R.A.F.V.R., No. 83 Sqn.
Flt. Sgt. A. N. L. MOSS, R.A.F.V.R., No. 35 Sqn.
Flt. Sgt. E. H. PACK, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. D. PAY, R.A.F.V.R., No. 51 Sqn.
Flt. Sgt. J. W. VARLEY, R.A.A.F., No. 101 Sqn.
Flt. Sgt. (now P/O.) A. DELLA STUA, R.C.A.F., No. 12 Sqn.
Flt. Sgt. D. J. LANGLEY, R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.

Foreign Decorations

THE KING has granted unrestricted permission for the wearing of the undermentioned decorations conferred upon the officers indicated in recognition of valuable services rendered in connection with the war:—

Conferred by the President of the United States of America

Air Medal

Flt. Lt. E. B. ELLIOTT, R.C.A.F.

Conferred by Her Majesty the Queen of the Netherlands

Cross of Commander of the Order of Orange Nassau (with Swords)

Group Capt. SIR LOUIS GREIG, K.B.E., C.V.O., R.A.F.

Armourers of the Cheetah Squadron, S.A.A.F. preparing belts of 20 mm. ammunition.

Conferred by the President of the Czechoslovak Government

Military Cross, 1939

F/O. E. D. EYLES, R.A.F.

Roll of Honour

Casualty Communiqué No. 356.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to dying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 133 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. J. Bamford; Sgt. P. R. Barlow; Flt. Lt. R. N. W. Bock; Sgt. G. W. Claydon; Flt. Sgt. W. R. Cooper; Flt. Sgt. D. F. Davies, D.F.M.; Sgt. D. G. Davies; F/O. F. E. Evans, D.F.M.; Sgt. M. E. Giles; Sgt. B. Heaton; Sgt. T. S. Howlett; P/O. H. M. Kennedy; Sgt. A. R. Laurence; Flt. Sgt. J. D. Luckhurst; Sgt. J. McConnell; W/O. D. Poulton; F/O. R. L. Proudfoot; Sgt. J. Rawson; Sgt. V. A. E. Theedom; Sgt. R. W. Theobald; Sgt. E. Thripp; Sgt. R. D. Trett; Sgt. S. D. Viggers; Sgt. S. Whiteley; Sgt. H. F. J. Woods; Sgt. L. F. Wright.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. A. Blackwell; F/O. A. C. Bonner; F/O. E. Crouch; Sgt. W. A. Davies; Sgt. J. E. Dean; F/O. W. A. Donnelly; Sgt. N. D. Ensor; F/O. W. McC. Girdwood; Sgt. A. Glover; Sgt. C. Gorton; F/O. C. Harrison; Flt. Sgt. K. Hayes; Sgt. B. Howe; Sgt. M. C. Jefferies; Sgt. E. R. Norburn; Sgt. G. D. Sharp; Act. Sqn. Ldr. D. L. Small; Sgt. E. Stanley; Sgt. P. Stephenson; Sgt. H. Sweet; P/O. J. C. M. Taylor; Sgt. B. Whitfield.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. T. Alexander; Sgt. S. R. Atwill; Sgt. A. C. Aylard; Sgt. D. F. R. Banks; Sgt. T. E. Baxter; Sgt. E. W. Betts; Sgt. J. A. Bland; Sgt. A. W. Bond; Sgt. I. D. Bradley; Sgt. A. W. Brighurst; Sgt. F. Burton; F/O. J. M. Campbell; L.A/C. P. Cashmore; Sgt. F. J. Chandler; Sgt. Church; Sgt. N. Cohen; Sgt. G. W. Cole; Sgt. C. H. Collins; Sgt. P. V. Cook; Sgt. R. J. M. Cox; Sgt. D. W. A. Crowley; Sgt. C. K. Davis; Act. Flt. Lt. F. De Naeyer; P/O. J. W. Edmonds; Sgt. K. R. Faulconbridge; Sgt. G. Fellows; Sgt. C. B. Freeman; Sgt. W. J. Glotham; F/O. D. S. Gooderham; Sgt. A. Goodhand; Sgt. F. Guy; P/O. K. S. Hailey; P/O. C. Halliday; Sgt. D. P. Hamilton; Sgt. A. Hawley; P/O. G. W. Heathcote-Peirson; Sgt. J. B. McM. Irving; Sgt. R. M. Jay; Sgt. H. Jenkins; Sgt. D. V. Jordan; F/O. W. B. Kcown; Sgt. H. J. P. Lackey; Sgt. W. S. Lees; P/O. F. H. Levi; Sgt. D. Lock; Sgt. G. Lyle; Sgt. J. S. MacAdam; Sgt. W. McDonough; Sgt. M. F. McKeon; Sgt. E. D. C. Mackintosh; Sgt. J. Mackintosh; Sgt. J. K. Manley; P/O. P. P. G. O'Brien; Sgt. W. J. Parks; Sgt. T. Riley; Sgt. A. E. P. Rochester; Sgt. I. W. Sanderson; Sgt. L. T. Scarfe; Sgt. J. Scott; Sgt. R. G. H. Sees; Sgt. P. T. Smith; Sgt. A. McC. Sutherland; Sgt. R. Swain; Sgt. C. R. L. Thornton; P/O. M. Tuckwell; Sgt. F. H. Walton; Sgt. J. W. N. Westlake; Sgt. J. C. L. Whiteman; Sgt. N. G. Whiting; Sgt. M. R. Williams; P/O. G. H. Willis; Sgt. F. P. Willsher.

WOUNDED OR INJURED IN ACTION.—Flt. Lt. P. C. Cobley, D.F.C.; Flt. Sgt. J. McHahon; Sgt. L. R. Noyes; Sgt. B. R. Phillips; Sgt. F. H. Taylor; F/O. G. W. Williams, D.F.M.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. R. O. Curtis; Flt. Sgt. N. F. Miles.

MISSING.—Flt. Sgt. J. F. Andrew; Act. Flt. Lt. R. R. G. Appleby, D.F.C.; Sgt. E. Atkinson; F/O. R. B. Baker; Sgt. A. W. C. Ball; Sgt. E. Berry; Sgt. J. Birtwhistle; F/O. O. D. Blaha, D.F.M.; Flt. Sgt. C. G. Bromham; F/O. R. R. Brown; Flt. Sgt. D. F. Burtenshaw; Sgt. T. Calvert, D.F.M.; Act. Flt. Sgt. N. D. Cameron; Act. Flt. Sgt. K. S. J. Chapman; Act. Flt. Sgt. R. W. Chinery; Sgt. N. H. Colebatch; Flt. Sgt. R. J. Collens; Sgt. A. E. Cowell; Flt. Sgt. D. Cromar, D.F.M.; P/O. J. D. R. Cromarty; P/O. W. Currie; Flt. Sgt. J. J. Davenport; F/O. J. W. F. Deane; Sgt. R. Dickenson; Sgt. R. H. Doull; Flt. Lt. A. H. Duringer, D.F.C., D.F.M.; Flt. Sgt. J. A. Dwelly; Flt. Sgt. A. C. East; P/O. N. G. Emery; Sgt. D. S. Fawcett; Sgt. R. A. W. Ferguson; Sgt. G. Firth; W/O. A. H. Flett, D.F.M.; Flt. Lt. G. A. J. Frazer-Hollins, D.F.C.; Act. Flt. Sgt. W. C. Gadsby; F/O. J. W. Gage; Sgt. A. E. Gates; Sgt. N. Gent; Sgt. J. B. Goravitch; Sgt. F. B. Grey; Sgt. H. F. Hales; Sgt. J. Hamilton; Sgt. J. H. Harman; Sgt. K. H. Harper; F/O. J. T. Harris; Sgt. E. Heap; Sgt. S. Henderson; P/O. J. T. Hitchen; Sgt. R. W. Homewood; Flt. Sgt. R. J. Hunter; F/O. D. R. Illingworth; Flt. Sgt. D. S. James; Sgt. D. R. Jesson; Sgt. G. John; P/O. G. A. Johnson; Sgt. R. A. W. Keetch; F/O. S. I. Kennedy, D.F.C.; Sgt. R. A. Kidleys; Flt. Sgt. P. C. King; Flt. Sgt. L. N. Lapthorne; Sgt. L. N. J. Laver; Sgt. S. Lewis; Flt. Lt. A. G. McAdam, A.F.C.; Sgt. G. Monk; F/O. R. L. Mooney, D.F.M.; F/O. L. F. Morgan; P/O. C. H. Mortimer; Sgt. P. Murray; P/O. E. C. Nixon, D.F.M.; Sgt. H. A. Norton; Sgt. E. A. Oldham; Act. Flt. Lt. I. MacL. Pearson; Sgt. A. S. Pilbeam; Flt. Sgt. S. T. Player; Flt. Sgt. D. R. Pocock; Flt. Lt. H. B. G. Poulton, D.F.C.; Flt. Sgt. S. W. Rayner; Flt. Sgt. I. C. Redfearn; Act. Sqn. Ldr. I. Robertson, D.F.C.; Flt. Sgt. B. L. Robinson; Sgt. W. Rumney; Sgt. A. W. Sherry;

W/O. C. J. Skinner; Flt. Sgt. G. E. Smith; F/O. P. Y. Stead, D.F.C.; Act. Flt. Lt. K. M. Steven; Flt. Sgt. S. B. Stevenson; Sgt. E. J. Takle; Sgt. H. W. Thornton; P/O. H. Tiller; Sgt. V. N. Trayler; Sgt. S. Turner; Sgt. J. Waters; Flt. Sgt. W. N. Waudby; F/O. A. Weldon, D.F.M.; P/O. R. J. Wheway; Flt. Sgt. L. T. Wilmshurst; Sgt. H. W. Witham; P/O. J. W. Woods; Sgt. F. E. Woolven; Flt. Sgt. J. Worsdale; P/O. T. Wright; F/O. C. E. Yeo; P/O. B. W. Zeal.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. D. P. Boulton; A/C.1 A. M. Winton.

KILLED ON ACTIVE SERVICE.—L.A/C. J. Broadhurst; A/C.2 H. J. P. Colley; Flt. Sgt. J. Lupton; Sgt. E. T. R. Millington; Sgt. K. H. Rosewell; Sgt. R. S. Schneer; Flt. Sgt. H. Sunderland.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. D. A. K. Treble.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. T. A. Corr; F/O. R. A. Dorsett.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. G. D. Bain; F/O. C. F. Hall; A/C.2 R. W. Hallam; Flt. Sgt. C. A. E James.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. E. Scott.

PREVIOUSLY REPORTED WOUNDED OR INJURED ON ACTIVE SERVICE, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—F/O. K. George.

DIED ON ACTIVE SERVICE.—L.A/C. E. A. Barnes; F/O. J. A. Cannon; L.A/C. L. Castle; Act. Flt. Lt. F. H. Dobson; A/C.2 T. M. Gibney; F/O. D. J. Grestock; L.A/C. E. H. Hibbard; L.A/C. C. F. J. Houghton; Sgt. G. W. M. Hunter; A/C.2 J. E. N. Moffatt; Sgt. J. F. Stetty.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Act. W/O. C. W. Annis; Sgt. W. M. F. Barnet; Act. Wing Cdr. K. H. Burns, D.F.C.; F/O. C. D. Farmer; F/O. M. Irwin; P/O. G. J. MacRae; Sgt. J. L. Snelling; Sgt. R. B. Spencer-Fleet; Flt. Lt. C. E. Turner.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. J. C. Atherton; Flt. Sgt. J. Dobinson; F/O. F. F. Fahey, A.F.M.; Flt. Sgt. J. W. A. Farthing; Flt. Sgt. H. J. Gill; Act. Flt. Lt. S. C. Hicks; Flt. Lt. B. A. Kuyvett, D.F.C.; F/O. C. R. Pickworth; P/O. E. J. Ross.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. S. Christie; Flt. Sgt. J. A. Grant; Sgt. J. Heath; Flt. Sgt. P. J. Hogan; Flt. Sgt. E. J. Kerr.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. L. N. Bain; F/O. F. Stuart; Flt. Sgt. G. R. Webb.

MISSING.—P/O. G. Ely; Flt. Sgt. W. P. Harrison; F/O. C. O. Heathcote; Sgt. C. Hemingway; Flt. Sgt. F. N. Looney; P/O. P. L. Symonds; Flt. Sgt. W. D. Toohey; P/O. J. Weatherill; Flt. Sgt. G. Woolf.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. G. B. Hollings; F/O. W. D. Langworthy, D.F.C.; Flt. Sgt. J. P. Worthington.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. H. N. Trowbridge.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. G. W. Guest; Sgt. J. A. Jordan; Sgt. J. R. E. Leger.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. C. J. Carmody; Act. Flt. Lt. G. A. Lunn; P/O. R. D. Mix; Sgt. F. Spino; Act. Flt. Lt. V. J. Thagard; Sgt. H. D. Van-Norman.

WOUNDED OR INJURED IN ACTION.—Sgt. T. L. F. Ross.

MISSING.—F/O. P. H. Ewing; F/O. W. A. Holmes-a-Court; Sgt. R. Losa; W/O. T. W. Myers; F/O. G. F. Nixon; Sgt. R. J. Stone; F/O. C. D. Wall.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. F. W. Letchford.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. McL. Boswell; Sgt. D. D. Coates; Sgt. J. C. Donaldson; Flt. Sgt. W. J. Douglas; Flt. Sgt. E. R. Jenkins; Sgt. E. H. R. Lamb; F/O. S. Latta; W/O. A. J. Milner; F/O. D. R. Scrymgeour; P/O. L. W. Tabor.

MISSING, BELIEVED KILLED IN ACTION.—F/O. G. Philp.

MISSING.—F/O. L. T. Findlay; Flt. Lt. S. M. McGregor; Act. Flt. Lt. L. W. Munro.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. P. L. Shepheard.

MISSING.—Lt. S. P. Beuke.

Casualty Communiqué No. 357

Of the names in this list 111 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—P/O. D. H. Skipp; Flt. Sgt. A. J. Maisbit

Mosquitoes are now operating against the Japs. It is interesting to see how well modern plywood will stand up to operational conditions in the tropics.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. A. N. Adams; Sgt. W. W. Bannatyne; Wing Cdr. R. G. Barrell, D.S.O., D.F.C.; Sgt. D. D. Cuthbert; Sgt. R. Dunn; Sgt. R. Fulthorpe; Sgt. N. Harris; Sgt. J. Hayhurst; Sgt. R. H. Pallender; Sqn. Ldr. E. F. St. Aubyn; Sgt. H. Thompson; F/O. J. R. Wilsdon.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. R. L. Amesbury; Sgt. R. M. Anderson; P/O. T. Armstrong; Sgt. J. F. Atkins; Sgt. D. A. Ball; Sgt. J. Bannaliss; Sgt. A. Beard; Sgt. F. H. Bennetton; Sgt. J. S. Blackburn; Sgt. R. Boydell; Sgt. D. N. Brown; F/O. J. G. Bruce, D.F.M.; Sgt. L. D. Bryant; Sgt. T. A. S. Buchanan; F/O. L. G. Burgess; Sgt. F. J. Cleasby; Sgt. R. F. Cocking; Sgt. A. A. Collins; Sgt. H. J. Coombes; Sgt. L. R. Cunningham; W/O. M. de Beauchamp-Collenette, D.F.M.; Sgt. G. L. Doidge; Sgt. E. F. Doolittle; Sgt. R. P. Dormer; F/O. D. A. N. Evans; P/O. A. L. Ford; Flt. Sgt. M. O'D. Fuller; Sgt. E. Garner; Sgt. F. G. R. Gibbs; Sgt. S. F. Gould; Sgt. D. W. Hagan; Sgt. L. Hainin; Sgt. S. Hammond; Sgt. R. E. Hardingham; Sgt. W. Harkness; Flt. Sgt. A. Hartley; P/O. L. W. G. Head; P/O. C. W. Hewitt; Sgt. K. J. Highsted; Sgt. J. Hogg; Sgt. K. G. Horne; Sgt. A. E. Howlett; Sgt. K. Hubbard; Sgt. J. B. Inglis; Sgt. J. R. Johnson; Sgt. T. Jopling; Sgt. A. C. Leppard; Sgt. N. Long; Sgt. C. Lowis; Sgt. S. S. McClellan; Sgt. N. Marshall; Sgt. A. W. G. Meech; P/O. P. A. K. Mockford; Sgt. F. Moore; Sgt. D. R. Munday; Sgt. P. T. Murphy; F/O. V. S. Neill; Sgt. H. Noar; F/O. T. Noble; Sgt. R. H. Oats; Flt. Sgt. F. Oliver, D.F.M.; Sgt. R. J. Palmer; P/O. L. H. Pattisson; Sgt. D. W. Payne; Act. Flt. Lt. W. J. Picken, D.F.C.; Sgt. G. G. Powis; Sgt. R. G. Pritchard; Sgt. B. H. Reeve; Sgt. A. H. Richardson; Sgt. R. H. Roberts; Sgt. G. H. Rogers; Sgt. R. J. Rooney; Sgt. I. P. D. Rushton; Sgt. M. Savage; Sgt. E. A. Shaw; Sgt. F. C. Sherratt; Sgt. C. R. Shields; Sgt. J. Short; Sgt. T. C. E. Simmons; Sgt. A. G. P. Sindrey; Sgt. R. E. Sloan; P/O. D. Spooner; Sgt. J. Stuart; Sgt. A. G. Surtees; Flt. Sgt. J. T. Taylor; F/O. P. A. Walker; Sgt. A. P. Warner; Sgt. H. H. Wensley; Sgt. D. F. West; Sgt. R. Williams; Sgt. P. C. Willars; Sgt. J. Willatt; Sgt. J. Wilson; Sgt. J. Woods.

WOUNDED OR INJURED IN ACTION.—F/O. J. C. Atkinson.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. H. F. Goode.

PREVIOUSLY REPORTED WOUNDED OR INJURED IN ACTION, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. P. L. White.

MISSING, BELIEVED KILLED IN ACTION.—F/O. R. G. MacLeod; Sgt. D. F. Thomas.

MISSING.—Sgt. C. Ablett; Flt. Sgt. K. Adrian; Act. Flt. Lt. P. Barber; P/O. J. P. Bassett; F/O. R. G. Boston; Flt. Sgt. E. P. Botting; Sgt. D. A. Briggs; Act. Sqn. Ldr. J. Brotherton-Ratcliffe; Flt. Sgt. F. R. Brown; Act. Sqn. Ldr. R. Brown; Sgt. S. Burnell; Sgt. K. A. J. Campbell; Sgt. H. Cherns; P/O. R. J. Child; Sgt. H. C. Cohen; Sgt. I. Coles; Flt. Sgt. W. H. C. Collins; Sgt. C. G. Crosby; Sgt. W. H. Cryer; F/O. R. R. T. Crump; F/O. J. H. Duncan; Flt. Sgt. T. Eckersley; F/O. R. J. Elderfield; Sgt. R. W. J. Evans; Sgt. R. Fabian; Sgt. W. H. Fairfield; Sgt. C. W. Farrant; Sgt. R. Ferguson; F/O. V. S. Flack; Flt. Sgt. L. F. Gillingham; Sgt. J. A. Hare; Sgt. J. Harris; Sgt. G. E. Heasman; P/O. M. Hewitt; Sgt. G. Holden; Sgt. E. A. Hooker; Sgt. W. P. Houston; Sgt. S. Hughes; Sgt. M. R. Hunt; Act. Sqn. Ldr. T. W. A Hutton; F/O. E. J. Jay; Flt. Sgt. L. A. Jeffries; F/O. S. Kidd; Sgt. D. Leatherbarrow; Sgt. R. F. Ledger; Flt. Sgt. R. M. Lee; Flt. Sgt. F. McPhee; Flt. Sgt. C. W. Matthews; Flt. Sgt. D. H. A. Morris; Flt. Sgt. C. J. Norris; Flt. Lt. F. O. J. Pearce; F/O. D. R. Perrin; Act. Sqn. Ldr. A. J. Pinhorn; F/O. K. P. Rand; F/O. F. D. Roberts; Sgt. J. Roberts; Flt. Sgt. D. Robertson; Flt. Sgt. L. Robinson; Flt. Lt. E. D. Smith; F/O. V. M. Sparkes; W/O. R. N. Stares; Sgt. J. Stock; Sgt. R. F. Taylor; Sgt. H. L. Thompson; F/O. G. A. Tull; Sgt. M. Turner; F/O. M. G. Turner; Flt. Sgt. A. G. Twitchett; Flt. Sgt. L. J. Warner; Act. Flt. Lt. W. H. L. S. Way; F/O. K. H. Wilde; Act. Flt. Lt. J. E. Wood; Sgt. K. A. Wright.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. D. M. Campbell; A/C.1 K. G. Cox; Act. Sqn. Ldr. C. N. B. Crisp; Cpl. D. B. Farley; Flt. Sgt. G. C. Gibson; L.A/C. H. McLeiland; Sgt. C. E. Norris; A/C.1 A. Robertson; Flt. Sgt. T. W. Sadleir; L.A/C. E. B. Smith; L.A/C. J. D. Thornton.

KILLED ON ACTIVE SERVICE.—F/O. P. D. Bailey; Sgt. V. G. Bailey; Sgt. E. S. Barlow; Sgt. R. C. H. Beal; Sgt. R. S. Borlase; Cpl. J. Brown; Sgt. R. E. F. Chester; Sgt. E. Clayton; A/C.1 G. Cornish; Cpl. R. S. Crate; Sgt. L. Dowse; Flt. Sgt. S. Draycott; Sgt. T. W. Ewen; Flt. Sgt. R. J. N. Ford; Sgt. K. H. Greenwood; F/O. R. E. Lay; Sgt. J. D. McDermid; F/O. K. G. Mullett; Sgt. V. E. Payne; Sgt. J. F. Phillips; F/O. S. G. Phillips; Sgt. W. Pinder; Sgt. A. Porter; Sgt. D. B. Rhodes; F/O. L. E. Richards; Sgt. P. Rogerson; F/O. D. A. Roper; Flt. Sgt. A. G. Ross; Flt. Sgt. W. P. Rumsey; Flt. Sgt. K. C. Seagrave; Sgt. G. E. Stokes; Sgt. T. R. Thompson; F/O. F. H. Tiplady; Flt. Sgt. J. E. Toomer; Sgt. R. H. Wright; L.A/C. T. F. Pilmer.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. C. F. Archer; F/O. A. R. Kingsley.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. K. Brown.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. A. McConnell; Sgt. W. C. Warman.

DIED ON ACTIVE SERVICE.—A/C.2 J. Bryan; Sgt. H. Francis; A/C.1 C. W. Golding; A/C.2 C. J. C. Hill; A/C.2 E. M. Kelly; Cpl. R. Lishman; A/C.1 W. D. H. Moore; F/O. A. O'Bree; Cpl. B. Shaw.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. E. C. Lambert.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. W. D. Cock; Flt. Sgt. C. J. Daley; P/O. B. A. McConnell; Flt. Sgt. H. L. Walker.

MISSING.—Flt. Sgt. H. L. Baets; Flt. Sgt. C. A. M. Barber; P/O. R. E. Berkley; F/O. W. H. Bowen; P/O. N. P. Chapman; P/O. J. A. Cleary; P/O. F. A. Connolly; Flt. Sgt. L. J. Sheean.

KILLED ON ACTIVE SERVICE.—W/O. A. H. Fotheringham.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. W. F. Campbell; W/O. H. G. Reid.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. H. A. Mead.

MISSING.—Flt. Sgt. J. S. Baldwin; W/O. R. J. Barrett; P/O. L. G. Dalgleish; F/O. R. M. Davenport; Sgt. N. A. Dixon; Flt. Sgt. H. N. Dunnett; P/O. J. J. R. T. Godin; F/O. N. E. Hanna; F/O. R. H. Head; W/O. D. L. Heard; F/O. H. F. Heninger; Flt. Sgt. L. MacO. Jackson; W/O. O. A. Keddy; Act. Sqn. Ldr. J. F. Lambert; W/O. F. A. Larsen; Sgt. D. S. McClelland; P/O. N. W. Maybee; F/O. E. R. Munro; Flt. Sgt. H. S. Reid; Flt. Lt. K. W. Sim; Sgt. P. F. J. Sykes.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. G. L. Brehaut.

KILLED ON ACTIVE SERVICE.—Sgt. N. W. Crawford; Flt. Sgt. J. E. Dalling; Flt. Sgt. E. J. Glass; Flt. Sgt. J. Henfrey; Flt. Sgt. W. J. Kilpatrick; Sgt. J. A. Y. Lamontagne; W/O. G. F. Larson; Sgt. H. T. McDonald; F/O. J. J. McHenry; F/O. J. G. MacLeod; Sgt. L. G. Martin; Flt. Sgt. H. P. Morrison;; Sgt. E. Savage; Flt. Sgt. A. L. Schoenthaler; F/O. G. A. W. Shank; Sgt. W. C. Thompson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. G. H. Barnett; Flt. Sgt. E. J. Funston.

SERVICE AVIATION

DIED ON ACTIVE SERVICE.—Flt. Lt. D. P. Kelly; Cpl. W. M. J. O'Connor.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Sgt. G. G. Wilde.

MISSING.—Flt. Sgt. L. G. Docherty; F/O. F. H. Greenaway; Flt. Sgt. J. A Lamb.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. A. L. Coulter; Flt. Lt. G. S. Harcourt; Flt. Sgt. O. E. D Louden; Flt Sgt J. O'Callaghan; W/O. T. K. Paul.

South African Air Force

KILLED IN ACTION.—Lt. B. Trotter.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Lt. H. F. Smith.

WOUNDED OR INJURED IN ACTION.—Lt. N. B. Gould.

Casualty Communiqué No. 358

Of the names in this list 116 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. P. Conway; L.A/C. A. Dugdale; P/O. C. K. Lewis; Sgt. A. D. Meynell; L.A/C. T. G. Moore; F/O. R. Stead.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. D. Cram; Sgt. R. Dewey; Sgt. T. Jaye; Sgt. W. C. A. Long; Sgt. E. L. Orchard; Sgt. G. Pegler; Sgt. P. Stephens; Sgt. N. E. Taylor.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. N. Ainsworth; Sgt. A. Aitken; Sgt. A. A. V. Ansell; Sgt. C. B. Barrott; Sgt. R. J. Barton; Sgt. L. J. Beech; Sgt. L. T. Brett; Sgt. J. W. R. Broadley; Sgt. E. Brown; F/O. B. Carey; P/O. H. G. R. Chiverton; Sgt. B. W. Cooper; Flt. Sgt. W. P. Daly; Flt. Sgt. P. B. Davies; Sgt. R. G. Fletcher; Sgt. K. P. Garnett; Sgt. B. Y. Ginn; P/O. R. H. Glover; Sgt. M. J. Grace; Sgt. P. R. Hall; P/O. C. D. Handley, D.F.M.; Sgt. A. M. Hodges; Sgt. J. Hodgson; Sgt. S. J. Houston; Sgt. J. H. Humphrey; Wing Cdr. D. V. Ivins; Sgt. W. J. Jackson; P/O. D. C. T. Jagger; Act. Flt. Lt. W. A. Jones; Sgt. J. Kay; P/O. D. A. King; Sgt. H. F. D. Lay; Sgt. M. H. V. Lewis; Sgt. D. R. Ling; Sgt. F. Long; Sgt. J. W. Lowe; Sgt. R. F. Lyster; Sgt. C. D. Mackelvie; Sgt. M. W. Mackenzie; Sgt. D. B. Martin; Sgt. J. H. Mastin; F/O. G. Meakins; W/O. T. J. Moss; F/O. J. L. Mouatt; Sgt. W. Nugent; Act. Wing Cdr. A. W. Pennington-Legh; F/O. H. Plant; Flt. Sgt. P. G. Polkinghorne; Sgt. E. Rabjohn; Flt. Sgt. S. V. Ramsay; F/O. L. E. Richbell; Sgt. D. C. Robinson; Sgt. B. L. Rogers; Sgt. D. R. W. Schofield; Sgt. P. Shortland; Sgt. D. J. Smith; Flt. Sgt. L. M. Smith; Sgt. J. Somerville; P/O. G. N. Sutton; Flt. Sgt. J. Talbot; Act. Flt. Lt. J. L. Taylor; Sgt. A. L. Thurlow; Sgt. C. D. Todd; Sgt. C. Vandy; Sgt. C. Warburton; Sgt. J. C. Waring; Sgt. R. L. Ward; Flt. Sgt. D. A. Watkins; Sgt. K. R. G. Williams; F/O. A. B. P. Wilson; Sgt. R. H. Winter; F/O. J. R. Worswick.

WOUNDED OR INJURED IN ACTION.—F/O. R. J. Hewett.

MISSING, BELIEVED KILLED IN ACTION.—F/O. H. E. Bennett; Sgt. L. F. Bostock; Sgt. W. A. Casey; Sgt. A. E. Eley; Sgt. D. A. J. Fisher; Sgt. W. Fleming; Sgt. R. Garside; Sgt. R. F. Mutton.

MISSING.—Sgt. A. McN. Anderson; Flt. Sgt. R. W. Basey; F/O. J. Battersby, B.E.M.; Sgt. R. M. Bond; Sgt. M. H. Britton; Sgt. V. De P. Brown; Flt. Sgt. R. G. E. Buckner; Sgt. A. B. Burke; Flt. Sgt. S. Burns; Sgt. D. Campbell; Flt. Sgt. R. K. Chapman; P/O. J. A. Cockin; F/O. W. B. Conn; F/O. F. M. Connolly; P/O. N. G. W. Cooper; Flt. Sgt. L. P. Coupe; Sgt. T. S. R. Dagnall; P/O. A. G. Dumbrell; Flt. Sgt. H. C. Dumbrill; Flt. Sgt. D. Edwards; Flt. Sgt. T. L. Evans; Flt. Lt. W. H. E. Fitzgearle; P/O. J. W. Flynn; Sgt. P. E. Gander; F/O. R. Gibson; Sgt. R. Gillies; P/O. J. E. Glendinning; Sgt. J. Graham; Sgt. C. A. Grant; Sgt. C. Griggs; F/O. T. Guthrie; Wing Cdr. P. E. Hadow; F/O. R. L. A. Hammill; P/O. T. H. Hastings; Sgt. P. M. Hayes; Sgt. R. W. Heaton; Sgt. A. B. Hicks; F/O. R. J. Hodges; Flt. Sgt. D. B. Jameson; Sgt. G. Kensall; Sgt. C. King; Sgt. S. W. Lamberth; F/O. K. S. Lear; Sgt. E. J. Lock; Sgt. S. J. Lunn; Sgt. W. Macadie; F/O. R. Macfarlane; Sgt. B. Machan; Sgt. V. Mandy; Flt. Sgt. T. Maynard; Sgt. A. C. R. Miles; Sgt. F. W. Mittonette; Sgt. C. S. Morgan; Flt. Sgt. J. B. Mullin; Sgt. R. R. Norton; F/O. G. C. Orme; Sgt. S. P. Page; Sgt. W. Phillips; P/O. C. Priest; F/O. W. R. Read; Sgt. T. J. Reynolds; Act. Flt Lt. G. Rice, D.F.C.; F/O. A. J. Rudman; Sgt. J. C. Scott; Sgt. W. T. Sibley; Sgt. J. P. Slater; Flt. Sgt. E. C. Smith; Sgt. R. Smith; L.A/C. C. W. Summers; F/O. F. J. Stuart; Sgt. F. R. Taylor; Flt. Lt. W. R. Wells; P/O. A. W. Whitmarsh; Sgt. G. E. Wilks; P/O. A. F. Wright.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—L.A/C. A. R. V. Hudson.

KILLED ON ACTIVE SERVICE.—Sgt. A. W. Davey; Sgt. K. Forster; Flt. Sgt. J. Fox; Sgt. F. Johnson; Flt. Sgt. A. Lipshitz, D.F.M.; Sgt. J. Quinn; L.A/C. N. E. Russell; L.A/C. G. C. Scarlett; Flt. Lt. J. F. Scholes.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Lt. E. W. Bitmead; Sgt. L. F. Parratt; F/O. J. E. Tickler.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. R. E. Baker; L.A/C. G. I. Buckman.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. W. H. Dyson; A/C.2 J. J. Hogarth; L.A/C. S. N. Ward.

DIED ON ACTIVE SERVICE.—Cpl. R. S. Coleman; Sgt. H. C. Davey; Cpl. A. Jordan; Cpl. J. Morrison; Sgt. A. Patterson; A/C.1 H. W. Skipper; L.A/C. P. M. Watt.

PREVIOUSLY REPORTED PRISONER OF WAR, NOW REPORTED DIED ON ACTIVE SERVICE.—P/O. J. M. Lewis.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. H. C. Billett; F/O. C. R. Fraser; Sgt. F. J. Frost; Sgt. J. Pollard; Sgt. C. Rees.

Royal Australian Air Force

KILLED IN ACTION.—F/O. D. W. Davidson; Flt. Sgt. F. W. Doonan; F/O. B. D. Heading; W/O. A. Molloy.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. G. E. McNaughton.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. Sqn. Ldr. H. T. Armstrong, D.F.C.; Flt. Sgt. H. E. Bull; F/O. A. M. Harvey; F/O. D. H. Paterson; Flt. Sgt. A. A. C. Peters.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. L. A. Chester; P/O F. C. Clucas; F/O. J. P. Grant; Sgt. R. H. Lawn; F/O. R. K. McIntyre; P/O. J. J. Moon; F/O. A. Robinson; Flt. Sgt. R. W. Rowley; F/O. E. C. Truscott; P/O. K. G. Whitting.

MISSING.—P/O. W. J. Armour; Flt. Sgt. R. J. Ayers; F/O. G. P. Beattie; Flt. Sgt. C. W. M. Corkill; P/O. D. C. Dripps; Flt. Sgt. A. H. Foxley; Flt. Sgt. G. W. Gordon; Flt. Sgt. G. A. Hebblewhite; Sgt. R. C. L. Hoskin; Flt. Sgt. G. H. Irvin; P/O. L. C. Morrison; P/O. J. Poole; P/O. F. F. Stokes; P/O. E. Weiland.

PREVIOUSLY REPORTED MISSING NOW REPORTED PRISONER OF WAR.—F/O. D. O. Cull.

Long-range tank for short journeys. A canoe improvised from a Me 109 drop-tank. The absence of a keel must make it a trifle unstable.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. J. M. Blake; Sgt. W. E. Edwards; Flt. Sgt. V. C. L. Knox; F/O. F. Phillips; W/O. D. L. Wright.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. McG. Allan; Flt. Sgt. R. F. Bird; Flt. Sgt. J. L. Guichard; P/O. J. A. McPhee; Sgt. C. H. Reed; Flt. Sgt. S. O. Schrump.

WOUNDED OR INJURED IN ACTION.—P/O. G. H. Falloon, D.F.M.; Act. Sqn. Ldr. I. C. Ormston, D.F.C.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. McL. Adamson; Flt. Sgt. P. T. Nelson.

MISSING.—P/O. G. V. Andrew; Sgt. G. W. Briffett; Sgt. W. R. Christien; F/O. A. E. Clarke; Flt. Sgt. G. H. Dudley; Act. Flt. Lt. R. J. Dunphy; P/O. W. R. Ferrier; F/O. A. A. Fischer; F/O. I. G. Gillespie; W/O. C. B. Gowrie; F/O. J. M. Grieve; F/O. J. G. Hatchwell; Sgt. G. H. Jessiman; Flt. Sgt. J. R. Jones; Flt. Sgt. J. L. Keighan; P/O. J. R. Kinney; F/O. R. M. McCabe; Flt. Sgt. R. L. McCulloch; Flt. Sgt. C. D. MacLachlan; W/O. W. F. Marshall; Sgt. J. R. Martin; F/O. C. W. Miller; F/O. K. M. Mosher; Flt. Lt. R. Munro; W/O. J. D. Pilkey; Sgt. W. M. Power; Sgt. E. S. Pridham; F/O. D. E. Raymond; Flt. Sgt. A. E. Salmon; F/O. C. R. Sandes; F/O. D. I. Smith; Sgt. S. S. Smith; Sgt. S. Sondergaard; W/O. C. F. D. Steel; F/O. J. E. Stewart; F/O M. S. Taylor; Sgt. T. W. Thompson; P/O. J. W. Thrasher; Flt. Sgt. E. L. Tycoles.

KILLED ON ACTIVE SERVICE.—W/O. F. C. Bushfield; Sgt. C. R. Choma; F/O. S. F. Cleworth; Flt. Sgt. M. L. John; F/O. J. J. McGavock, D.F.C.; F/O. T. E. Major; F/O. A. G. Orr.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Act. Flt. Lt. M. A. Cybulski, D.F.C.; F/O. F. H. Eilertson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. R. T. J. Welch.

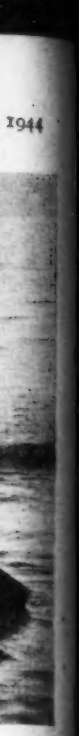
DIED ON ACTIVE SERVICE.—Sgt. H. W. H. Hare.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. T. Froats.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Sgt. F. E. Hotherall.

KILLED ON ACTIVE SERVICE.—P/O. T. J. Bayton; F/O. N. S. Black; Sgt. H. G. Corin; F/O. P. R. Galbraith; Flt. Sgt. W. Hornung; Sgt. A. C. Howell; Sgt. V. C. Howes; Sgt. P. T. Hunter; F/O. I. D. Prebble; P/O. J. H. Stowell.

South African Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Lt. E. B. C. Lahaer.